Aprilaire®

Humidifier

Steam Humidifier

Models 1150, 1160, and 1180

Installation, Operation, and Maintenance Manual

READ AND SAVE THESE INSTRUCTIONS

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WARRANTY . . . . . Back Cover

ATTENTION INSTALLER

This product must be installed by qualified HVAC and electrical contractors. Failure to do so voids product warranty due to possible product misapplication.

This product must be installed in compliance with local, state, and federal codes.

CAUTION

1. Do not set humidity higher than recommended. Condensation damage may result.
2. Failure to follow the instructions in this manual for installation of distribution tube, airflow proving switch, and high humidity limit switch may cause condensation damage.

WARNING

1. Line voltage may cause serious injury or death from electrical shock. Disconnect power before installing supply wiring.
2. Water temperature in excess of 140°F (60°C) may cause serious injury due to burns. Allow unit to cool before draining or removing chamber.
3. The humidifier chamber, distribution assembly, and all connected hose or piping may contain or discharge hot steam and/or hot water at 212°F (100°C). Discharged steam is not visible. Contact with hot surfaces, discharged hot water, or air into which steam has been discharged may cause severe personal injury.
4. Water pressure greater than 120 psi (827 kPa) may cause the humidifier to overflow.
5. Humidifier weighs up to 101 lbs (46 kg) when operating. Improper mounting of humidifier may cause humidifier to fall from wall or ceiling resulting in serious injury. Mount humidifier to a structurally stable surface per the instructions in this manual.
6. Failure to properly ground unit may result in property damage due to fire, or serious injury or death from electrical shock.
7. Failure to follow the instructions in this manual may cause moisture to accumulate, which may cause bacteria and mold growth or dripping water into building spaces. Dripping water may cause property damage.

PRODUCT OVERVIEW

Aprilaire Steam Humidifiers create steam by boiling water inside a steam chamber. This is accomplished by the transfer of energy from electric heating elements to the water inside the chamber. A three-level water probe is used to determine when to turn on and off a water fill valve in order to bring water into the chamber. Once the chamber is full and there is a call for humidity from the Automatic Steam Humidifier Control, the heating elements will be energized causing the water to boil. The boiling water creates steam which, due to the moderate pressurization of the chamber that comes from boiling, is forced through the vapor hose and steam distribution tube into the duct system. As water is boiled off, the water level in the steam chamber will drop. The water probe will sense when it reaches a low point and will cause the fill valve to open.

The process of boiling the water in the steam chamber will cause minerals and impurities in the water to drop out. Depending on the hardness and quality of the water, this can create a substantial build-up within the steam chamber. The unit will drain the chamber periodically to help clean the steam chamber and reduce the amount of cleaning required during maintenance.

Aprilaire Steam Humidifiers are controlled by an Automatic Steam Humidifier Control mounted in the return duct that will sense the relative humidity (RH) in the return air. If the return air is below the RH setpoint, the control will send the humidifier a signal to begin producing steam. Once this happens, the airflow proving switch (included) will check to ensure that the equipment blower is operating. If the blower is not operating, the humidifier can send the equipment a signal to turn the fan on.

- The Aprilaire Steam Humidifier Model 1150, 12 lb/hr unit, features an Automatic Steam Humidifier Control with on/off control. The on/off control will send a 10 VDC signal to the humidifier when the measured return air RH is 3% or more below setpoint to turn the unit on at 100% output.
- The Aprilaire Steam Humidifier Model 1160, 24 lb/hr unit, and the Model 1180, 48 lb/hr unit, feature an Automatic Steam Humidifier Control with modulating control. This control sends a signal between 0 and 10 VDC that is proportional to the difference between setpoint RH and the measured return air RH. The signal for 100% humidifier output is 10 VDC and occurs at a control point that is adjustable. The signal for 50% output is 5 VDC and occurs at the setpoint. The adjustable RH proportional control band can be set on the board to 6%, 9%, 12% (default), or 15%. The humidifier uses this varying signal to time-proportion the operation of the heating elements in the chamber.

The Automatic Steam Humidifier Control features an outdoor temperature sensor and is equipped to provide RH setpoint compensation based on the actual outdoor temperature. When the weather gets colder outside, there can be problems with condensation when introducing humidity into the building. The control recognizes this and adjusts the setpoint in the building to a lower level. The control will still provide humidity to the building, but will not attempt to maintain a humidity level higher than is appropriate for the current outdoor temperature. For applications that require specific set-point control, regardless of outdoor temperature, the Control can be set up for manual operation. In Manual Mode, the outdoor temperature sensor is not used and the RH is controlled to the specific setting on the Control.

MATERIALS PROVIDED

1 Humidifier (Model 1150: 1 heater, 12 lbs/hr; Model 1160: 2 heater, 24 lbs/hr; Model 1180: 3 heater, 48 lbs/hr)

1 Distribution Tube (Model 1150: 10" active, 14" overall; Model 1160: 16" active, 20" overall; Model 1180: 25½" active, 29½" overall.

1 10 ft. Steam Hose, 1½" I.D. for Models 1150/1160, 2" I.D. for Model 1180

1 1 ft. Drain Hose, 1" I.D.

2 Hose Clamps (for Steam Hose)

2 Hose Clamps (for Drain Hose), 1" I.D.

2 Face Plates for Mounting Distribution Tube (1 set)

2 3/8" x 2" Lag Bolts for Mounting Humidifier

1 Automatic Steam Humidifier Control

1 Airflow Proving Switch

1 Installation, Operation, and Maintenance Manual

MATERIALS NOT PROVIDED

Electrical Supplies – quick disconnect box, conduit, and wire (for power to the unit and wiring to control devices)

Plumbing Supplies – supply and drain piping, fittings, etc.

High Humidity Limit Switch

Hanging Bracket Kit (P/N 4593) – for mounting humidifier from ceiling

Plastic Tubing, ¼" I.D. – for airflow proving switch

Sheet Metal Screws – for attaching distribution tube faceplate

FIGURE 1 – Product Overview

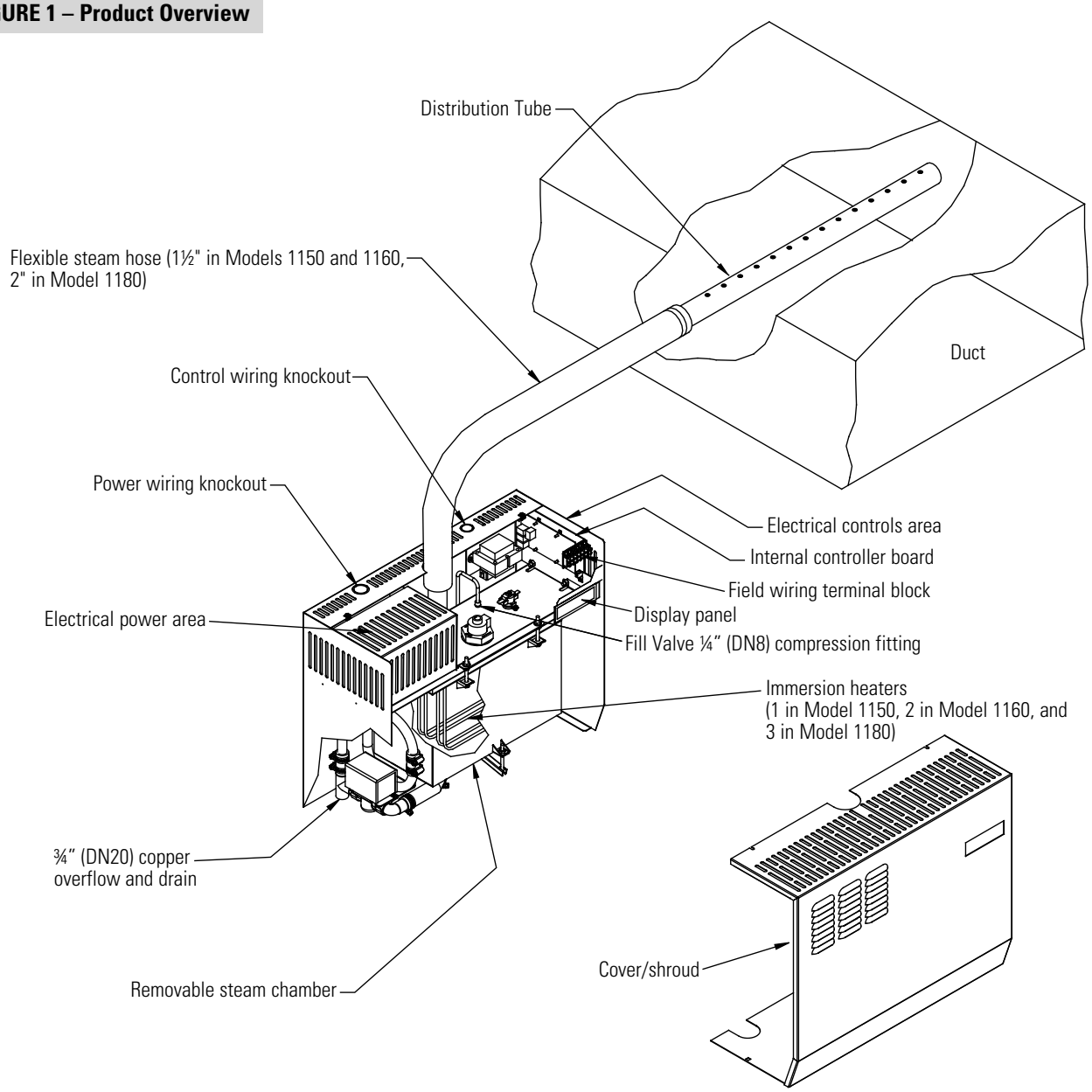
Distribution Tube
Flexible steam hose (1½" in Models 1150 and 1160, 2" in Model 1180)
Duct
Control wiring knockout
Power wiring knockout
Electrical controls area
Internal controller board
Field wiring terminal block
Display panel
Electrical power area
Fill Valve ¼" (DN8) compression fitting
Immersion heaters (1 in Model 1150, 2 in Model 1160, and 3 in Model 1180)
¾" (DN20) copper overflow and drain
Cover/shroud
Removable steam chamber
OM-4051

TABLE 1 – Electrical Specifications

Model number	Maximum steam capacity		Current draw (amps)		Circuit Breaker (amps) minimum	kW	Shipping weight (includes packaging and all materials in the box)		Operating weight (humidifier only, with water in chamber)	
			Single-phase	Three-phase						
	lbs/hr	kg/h	240V*	240V*			lbs	kg	lbs	kg
1150	12	5.4	16.7	--	25	4	70	32	59	27
1160	24	10.9	33.3	--	45	8	75	34	68	31
1180	48	21.8	--	38.5	50	16	88	40	101	46

Note: Models 1150,1160 and 1180 operate at 50/60 Hz.

* 208V may also be used but the steam capacity will be approximately 25% lower than the values above. It is recommended that the same size circuit breakers be used with 208V as listed above for 240V.

FIGURE 2 – Dimensions (pertains to Models 1150, 1160 and 1180)

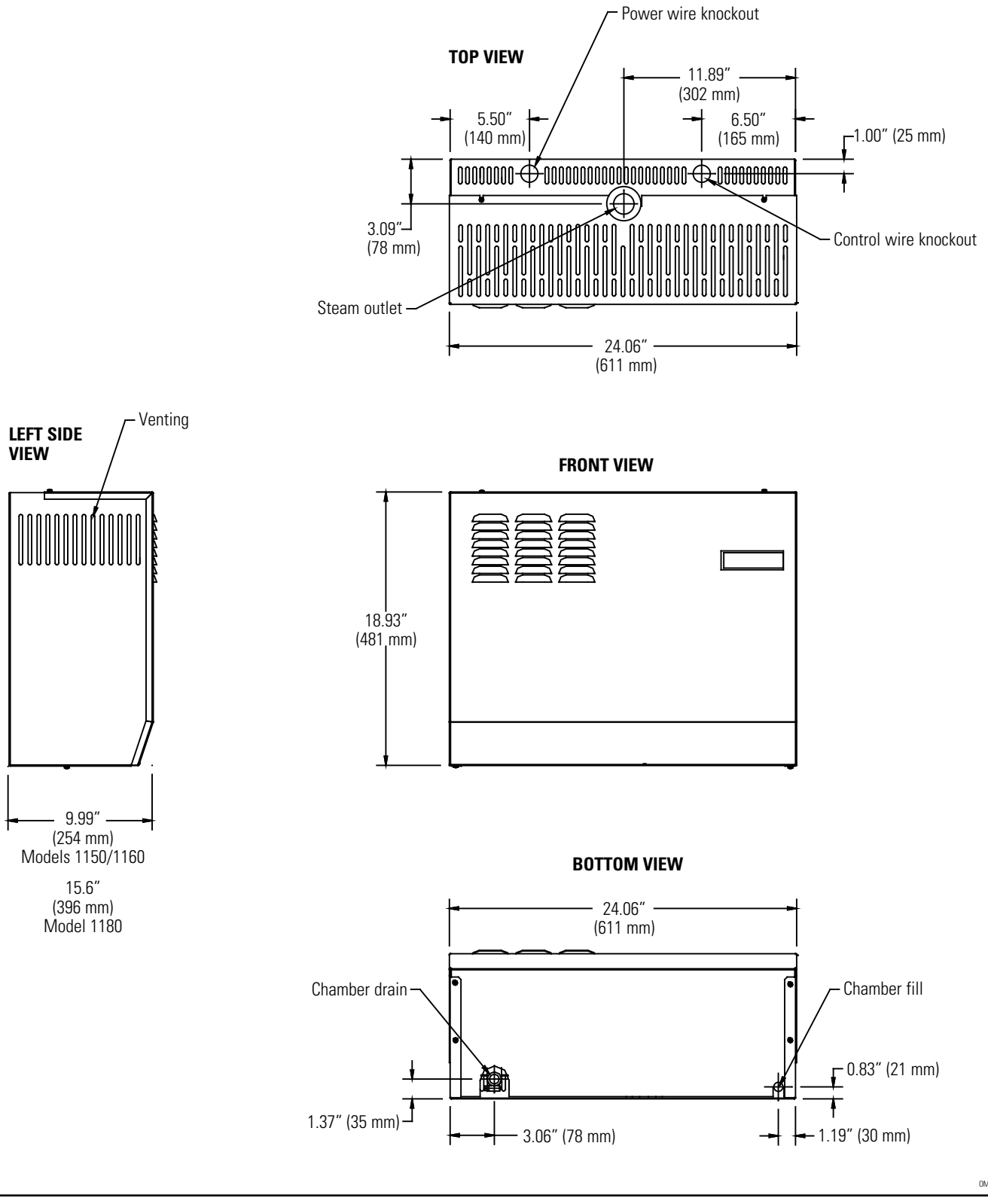

FIGURE 3 – Mounting Hole Locations

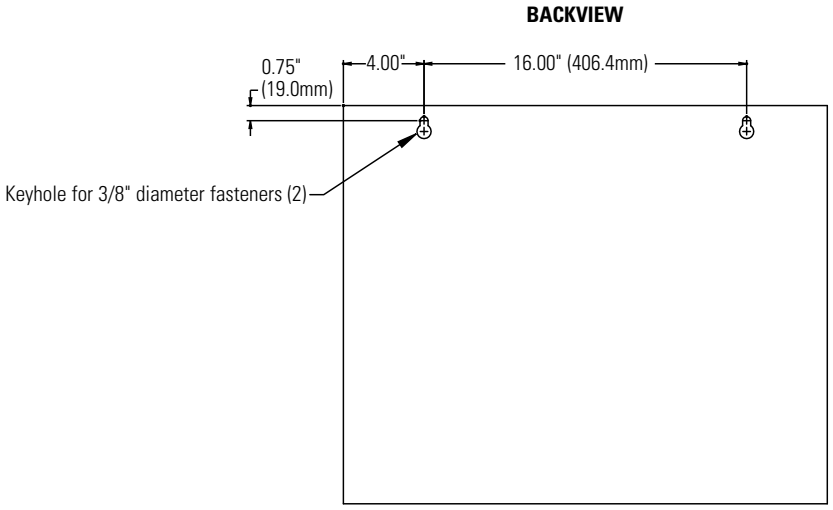

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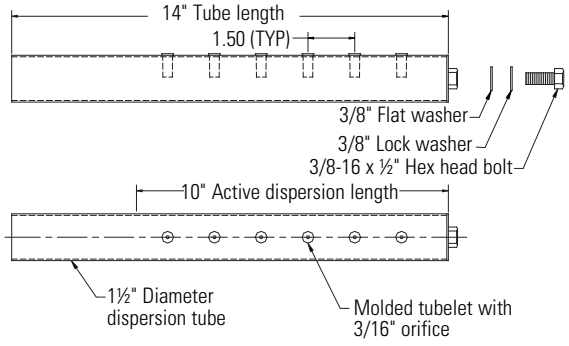
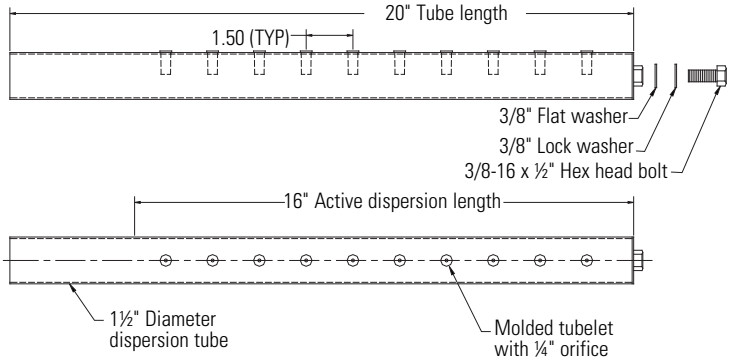
FIGURE 4 – Distribution Tube Dimensions

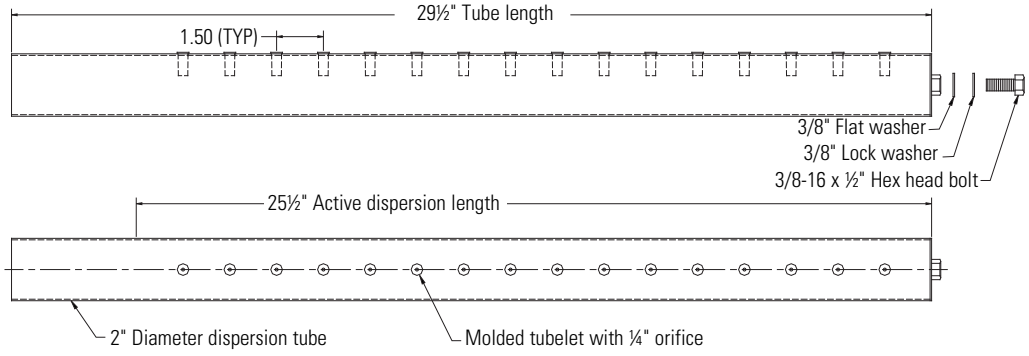
MODEL 1150



MODEL 1160



MODEL 1180



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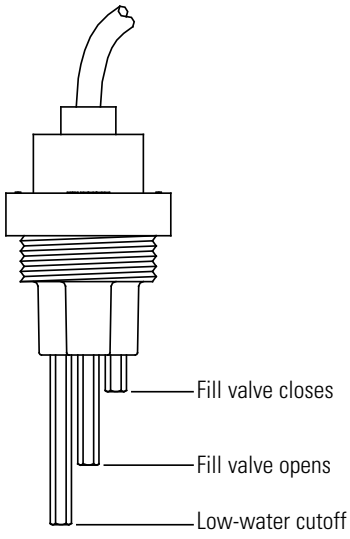
INTERNAL CONTROLLER - FEATURES OF OPERATIONS

The internal controller within the humidifier cabinet responds to external inputs (e.g., humidistat and airflow proving switch) and internal inputs (e.g., water level probe inside the steam chamber) to provide:

- **Relative humidity (RH) control**
  – Model 1150: With an on-off demand signal, the controller maintains RH within 5% to 7% of set point.
  – Model 1160 and 1180: With a modulating demand signal, the humidifier maintains RH within 2% to 4% of set point. Modulating demand signal options include a 0–10 VDC humidistat signal (humidistat provided), or a signal by others (0–10 VDC or 4–20 mA).
- **Automatic water level control and safety shut-down**
  If there is insufficient water, an electronic water level probe sends a signal to the controller to add water or to turn off the heaters. (See **Figure 5**.)
- **Operating time monitoring**
  The controller accumulates humidifier run time to activate end-of-season draining, water cool-down, and auto draining.
- **Automatic preheating**
  – Model 1160 and 1180: During normal operation, in the case of a re-fill cycle or a period of no demand for humidity, the controller will recognize that the tank has cooled down. The heaters will energize for an appropriate amount of time to bring water close to boiling temperature. Preheat only occurs when there is a demand for humidity.
- **Automatic end-of-season draining**
  If the humidifier doesn't receive a humidity demand signal for 72 hours, the chamber automatically drains.
- **Periodic drain and flush**
  To reduce mineral buildup in the chamber, the humidifier automatically drains at intervals based on operating time, output capacity, and water type. At the end of the drain cycle, the supply water is brought on to briefly flush the chamber.
- **Chamber water cooling before draining**
  To ensure that water is at or below 140°F (60°C) before discharging to the plumbing system, the humidifier remains idle for a defined period of time before draining.
- **Ensuring duct airflow**
  The humidifier will not make steam unless the HVAC system blower is on and the airflow proving switch verifies there is airflow in the duct.

FIGURE 5 – Electronic Water Level Probe



The humidifier monitors and controls water levels electronically using a three-rod probe. The humidifier responds with the above actions when the water level reaches each probe rod.

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SEQUENCE OF OPERATIONS

Note: Sequence is for normal operation, starting with an empty Steam Chamber.

Model 1150 Humidifier is connected to: 240 VAC, single phase input power; Model 57 on/off Automatic Steam Humidifier Control (ASHC); Airflow Proving Switch and High Humidity Limit Switch. Water supply is turned on, steam distribution and drain connections are made.

TABLE 2 – Sequence of operation for Model 1150

Operation	Expected Results
Humidifier power turned on.	• Internal Controller (LW420) powered up. • LEDs blink - On/Off LED stays on. • +24 VDC available at terminal #30 on humidifier referenced to C.
Fill Sequence: Water level probe will sense an empty chamber and turn on the fill valve.	• After a few second delay, the Fill LED will turn on and the fill valve will open. The Fill LED will remain lit as long as the fill valve is open. • Water will flow into steam chamber. Note: It takes approximately 5 minutes to fill the Model 1150 chamber. • Water level probe will sense a properly filled chamber and Fill LED will turn off . • Fill valve will close.
Demand for humidity from control circuit: (ASHC is calling for humidity and airflow is present.)	• ASHC will send a nominal 10 VDC signal from H+ to terminal #1 on humidifier. • Fan Relay will energize in a few seconds. • LW420 will check for a closed 'enable' circuit between terminal #2 and C (Airflow Proving and High Humidity Limit check). • If 'enable' circuit is closed, Steam LED will turn on and remain on as long as the call for humidity is present. • After a 15 second delay, the Safety Relay will be energized. • After a 3 second delay, the Control Relay will be energized. • Heating element will be energized. • After about ten minutes, the water will boil and steam will be generated and forced out of chamber, up through hose and dispersion tube into the duct. • **CAUTION**: Steam chamber and hose will be very hot. • NOTE: During the initial start-up, steam hose may emit an odor.
As water is boiled off, the water level drops and the water level probe will sense a need for more water in the chamber.	• See *Fill Sequence* listed above.
Demand for humidity is satisfied.	• Steam LED will turn off. • Control Relay will be de-energized after 15 seconds. • Power will be disconnected from heating element. • After a minute, Safety Relay will be de-energized. • Fan Relay will be de-energized after 5 minutes.
After a predetermined amount of run time (element energized), an Autodrain sequence is performed. The control will initiate Autodrain during a period of inactivity when the water in the chamber is cool.	• The Drain LED will turn on and the drain valve will open allowing water to drain from the bottom of the chamber. • The drain valve will remain open for 12 minutes after the water level in the chamber drops below the lower probe. • The Fill LED will turn on and the Fill valve will open. The Fill valve will remain open until the water in the chamber reaches the upper probe, at which point the fill valve will close and the Fill LED will turn off. • NOTE: When the water in the chamber reaches the lower probe, if there is a demand for humidity, the heating element will be energized.
If demand for humidity prevents the chamber from cooling, a forced Autodrain sequence is initiated. During a forced Autodrain sequence, the humidifier will not generate steam, even if there is a call for humidity.	• The humidifier will go into a forced cool-down period, which lasts about 3 ½ hours. During that time, all the LEDs will blink in sequence. • After the forced cool down period, the Fill LED will turn on – the Fill valve will open, water will flow into chamber until it reaches the upper probe. • Drain LED will turn on and the drain valve will open allowing water to flow from the bottom of the chamber. • The drain valve will remain open for 12 minutes after the water level in the chamber drops below the lower probe. • The Fill LED will turn on and the Fill valve will open. • When the water in the chamber reaches the lower probe, if there is a demand for humidity, the heating element will be energized. • The Fill valve will remain open until the water in the chamber reaches the upper probe, at which point the fill valve will close and the Fill LED will turn off.
End of season drain.	• After 72 hours of no demand for humidity, the Drain LED will turn on and the drain valve will remain open for 10 hours. • After 10 hours, the Drain LED will turn off and the Drain valve will close. • The chamber will remain empty until there is a demand for humidity.

SEQUENCE OF OPERATIONS

Note: Sequence is for normal operation, starting with an empty Steam Chamber.

Model 1160 humidifier is connected to: 240 VAC, single phase input power; Model 57 modulating Automatic Steam Humidifier Control (ASHC); Airflow Proving Switch and High Humidity Limit Switch. Water supply is turned on, steam distribution and drain connections are made.

Model 1180 humidifier is connected to: 240 VAC, three-phase input power; Model 57 modulating Automatic Steam Humidifier Control (ASHC); Airflow Proving Switch and High Humidity Limit Switch. Water supply is turned on, steam distribution and drain connections are made.

TABLE 3 – Sequence of operation for Model 1160 and 1180

Operation	Expected Results
Humidifier power turned on.	• Internal Controller (LW420) powered up. • LEDs blink - On/Off LED stays on. • +24 VDC available at terminal #30 on humidifier referenced to C.
Fill Sequence: Water level probe will sense an empty chamber and turn on the fill valve.	• After a few second delay, the Fill LED will turn on and the fill valve will open. The Fill LED will remain lit as long as the fill valve is open. • Water will flow into steam chamber. Note: It takes approximately 7 minutes to fill the Model 1160 chamber and 12 minutes to fill the Model 1180 chamber. • Water level probe will sense a properly filled chamber and Fill LED will turn off . • Fill valve will close.
Demand for humidity from control circuit: (ASHC is calling for humidity and airflow is present.)	• ASHC will send a DC signal from H+ to terminal #1 on humidifier. The signal will range from 1 to 10 Volts DC depending on the difference between the ASHC set-point and the actual RH. • The Fan Relay will energize in a few seconds. • The LW420 will check for a closed 'enable' circuit between terminal #2 and C (Airflow Proving and High Humidity Limit check). • If 'enable' circuit is closed, Steam LED will turn on and remain on as long as the call for humidity is present. • The Steam LED will stay on unless the 'enable' circuit opens or the ASHC signal drops below 1 VDC. • After a 15 second delay, the Contactor will close, energizing the heating elements. • After about ten minutes, the water will boil and steam will be generated and forced out of chamber, up through hose and dispersion tube into the duct. • **CAUTION**: Steam chamber and hose will be very hot. • NOTE: During the initial start-up, steam hose may emit an odor.
As water is boiled off, the water level drops and the water level probe will sense a need for more water in the chamber.	• See *Fill Sequence* listed above.
Pre-heating of water.	• During normal operation, in the case of a re-fill cycle or a period of no demand for humidity, the controller will recognize that the tank has cooled down. The heaters will energize for an appropriate amount of time to bring water close to boiling temperature. Preheat only occurs when there is a demand for humidity.
Demand for humidity is satisfied.	• Steam LED will turn off. • The contactor will open after 15 seconds and the heating elements will be de-energized. • The Fan Relay will be de-energized after 5 minutes.
After a predetermined amount of run time (element energized), an Autodrain sequence is performed. The control will initiate Autodrain during a period of inactivity when the water in the chamber is cool.	• The Drain LED will turn on and the drain valve will open allowing water to drain from the bottom of the chamber. • The drain valve will remain open for 12 minutes after the water level in the chamber drops below the lower probe. • The Fill LED will turn on and the Fill valve will open. • The Fill valve will remain open until the water in the chamber reaches the upper probe, at which point the fill valve will close and the Fill LED will turn off. • NOTE: When the water in the chamber reaches the lower probe, if there is a demand for humidity, the heating element will be energized.

continued on next page...

TABLE 3 – Sequence of operation for Model 1160 and 1180 (continued)

Operation	Expected Results
If demand for humidity prevents the chamber from cooling, a forced Autodrain sequence is initiated. During a forced Autodrain sequence, the humidifier will not generate steam, even if there is a call for humidity.	• The humidifier will go into a forced cool-down period, which lasts about 6 hours for Model 1160 and 7 hours for Model 1180. During that time, all the LEDs will blink in sequence. • After the forced cool down period, the Fill LED will turn on – the Fill valve will open, water will flow into chamber until it reaches the upper probe. • Drain LED will turn on and the drain valve will open allowing water to flow from the bottom of the chamber. • The drain valve will remain open for 12 minutes after the water level in the chamber drops below the lower probe • The Fill LED will turn on and the Fill valve will open. • When the water in the chamber reaches the lower probe, if there is a demand for humidity, the heating element will be energized· • The Fill valve will remain open until the water in the chamber reaches the upper probe, at which point the fill valve will close and the Fill LED will turn off.
End of season drain.	• After 72 hours of no demand for humidity, the Drain LED will turn on and the drain valve will remain open for 10 hours. • After 10 hours, the Drain LED will turn off and the Drain valve will close. • The chamber will remain empty until there is a demand for humidity.

DISPLAY PANEL AND INDICATOR LIGHTS

The display panel shows operating status and troubleshooting information. See the display panel detail (**Figure 6**) and the table describing display panel lights (**Table 4**). For more information about blinking indicator lights, see the troubleshooting section in this manual.

FIGURE 6 – Display Panel

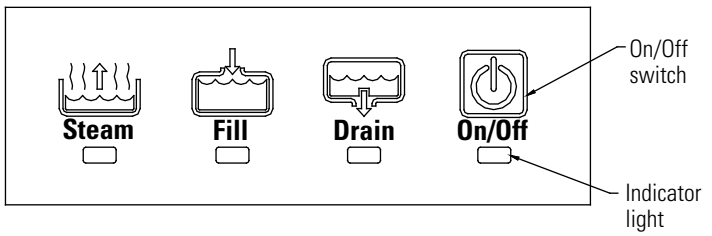


TABLE 4 – Display Panel Light Indications		
Indicator light(s)	Status	Description
All	Blinking sequentially	The humidifier is in a forced cool-down period prior to a required automatic drain sequence. Normal operation.
On/Off (switch)	On	Power is on. Normal operation.
	Slow blinking (1/sec.)	The electronic water level probe needs cleaning.
	Fast blinking (10/sec.)	Probe logic fault. See Troubleshooting section.
Drain	On	The humidifier is draining. Normal operation.
	Blinking	The allowed amount of time for draining has been exceeded. Fault in drain operation. Humidifier will continue to operate. See Troubleshooting section.
Fill	On	The humidifier is filling. Normal operation.
	Blinking	The allowed amount of time for filling has been exceeded. Fault in fill operation. Humidifier will not operate. See Troubleshooting section.
Steam	On	The humidifier is making steam. Normal operation.
	Blinking	The humidifier has received a demand signal but cannot make steam because: • There is not enough water in the chamber, or • An enable/safety switch is open
Note: See the Troubleshooting section in this manual for more information.		

AUTODRAIN SEQUENCE

The humidifier drains and flushes automatically at regular intervals to remove minerals from the chamber.

After the humidifier has run for a preprogrammed amount of time, and if there is no demand for humidity, the humidifier sits idle until the chamber cools and then it drains.

If the humidifier has not completed an autodrain sequence due to continual demand signal interruptions, after an additional amount of run time the humidifier begins a cool-down period and then it drains.

IMPORTANT: The humidifier attempts to complete an autodrain sequence when there is no demand for humidity. However, if an autodrain sequence is not completed within a defined period of time, the humidifier ignores the demand signal until completing an autodrain sequence. This could cause the relative humidity level in the humidified space to drop until the autodrain sequence completes.

FIGURE 7 – Model 1150 Wiring Diagram

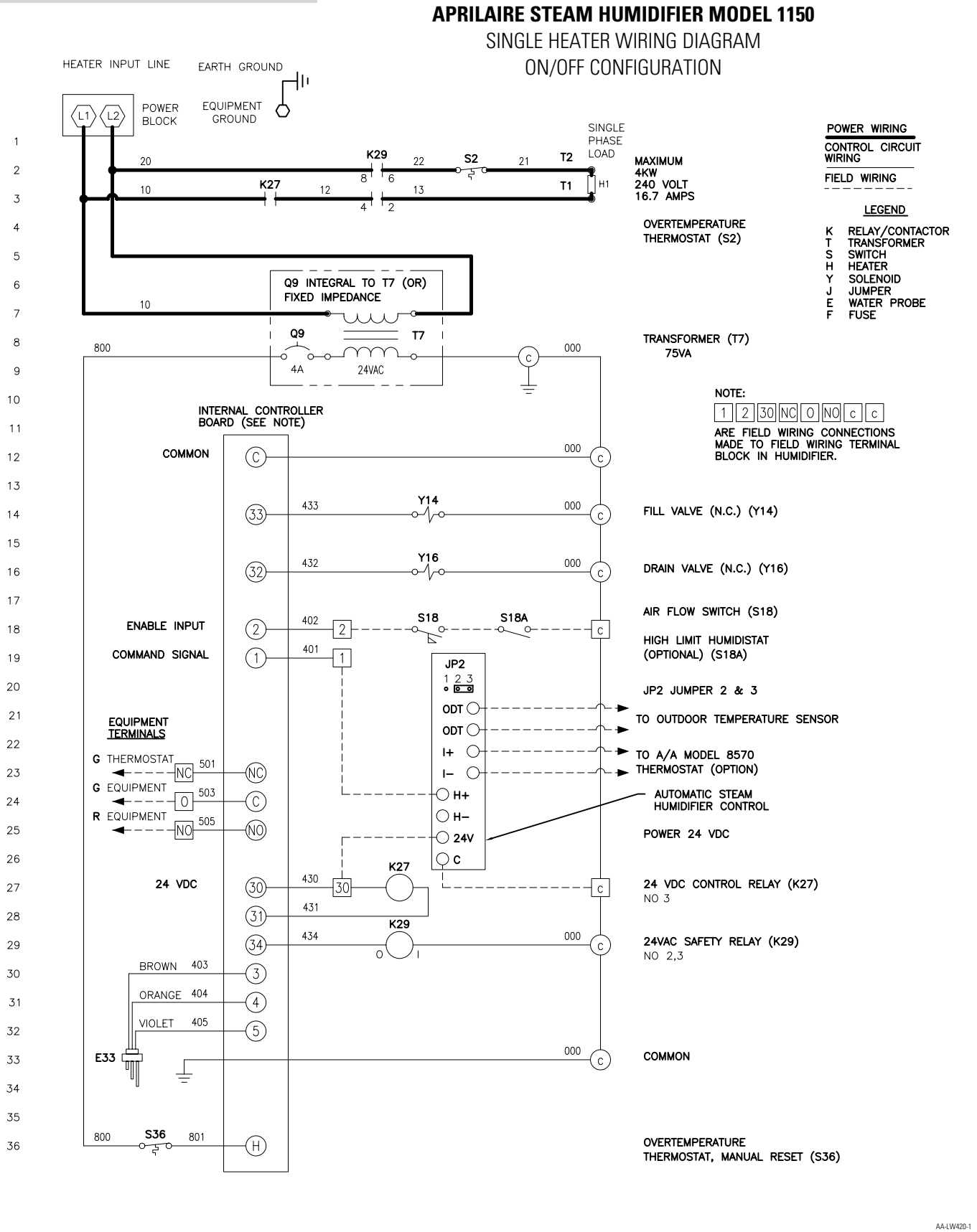


FIGURE 8 – Model 1160 Wiring Diagram

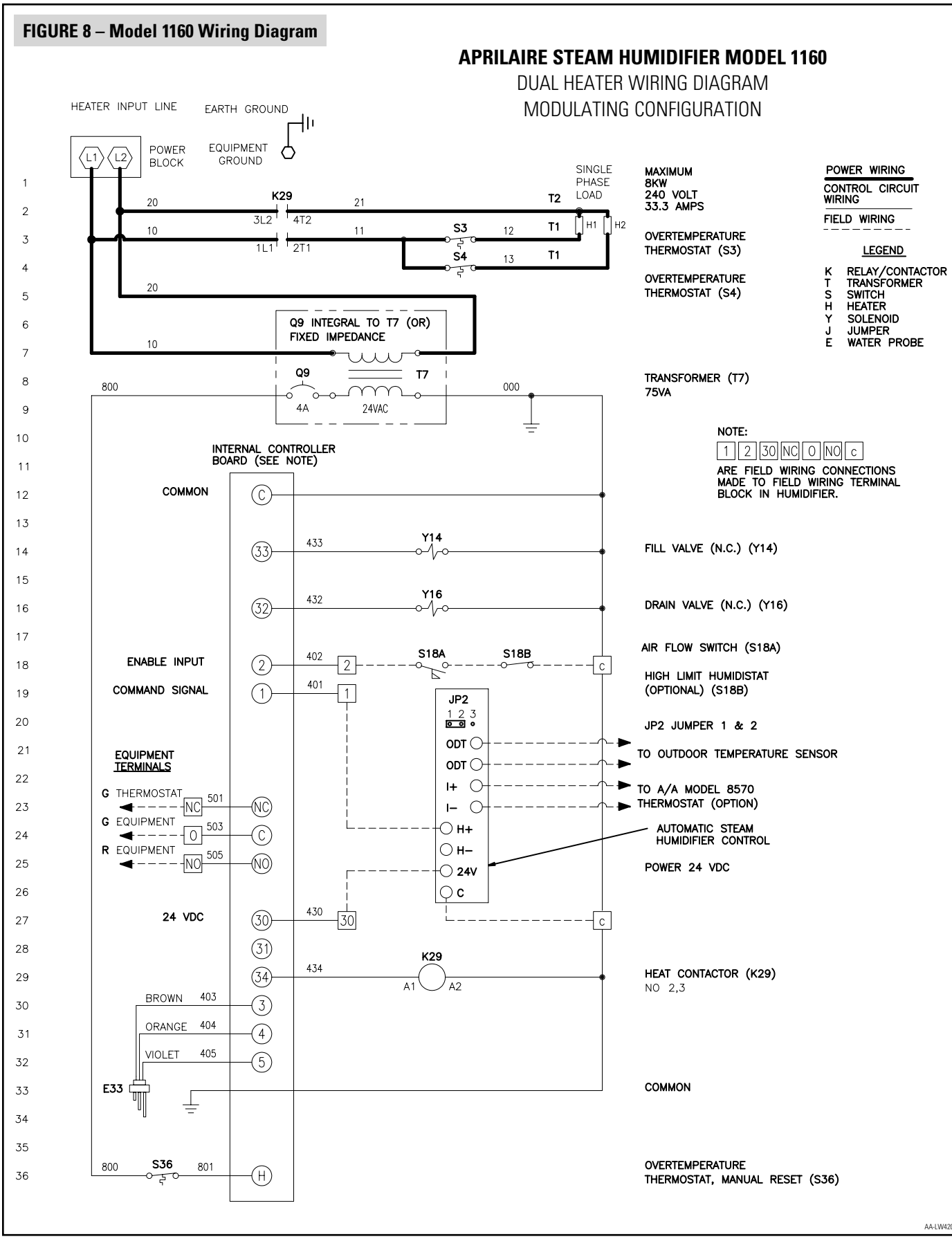
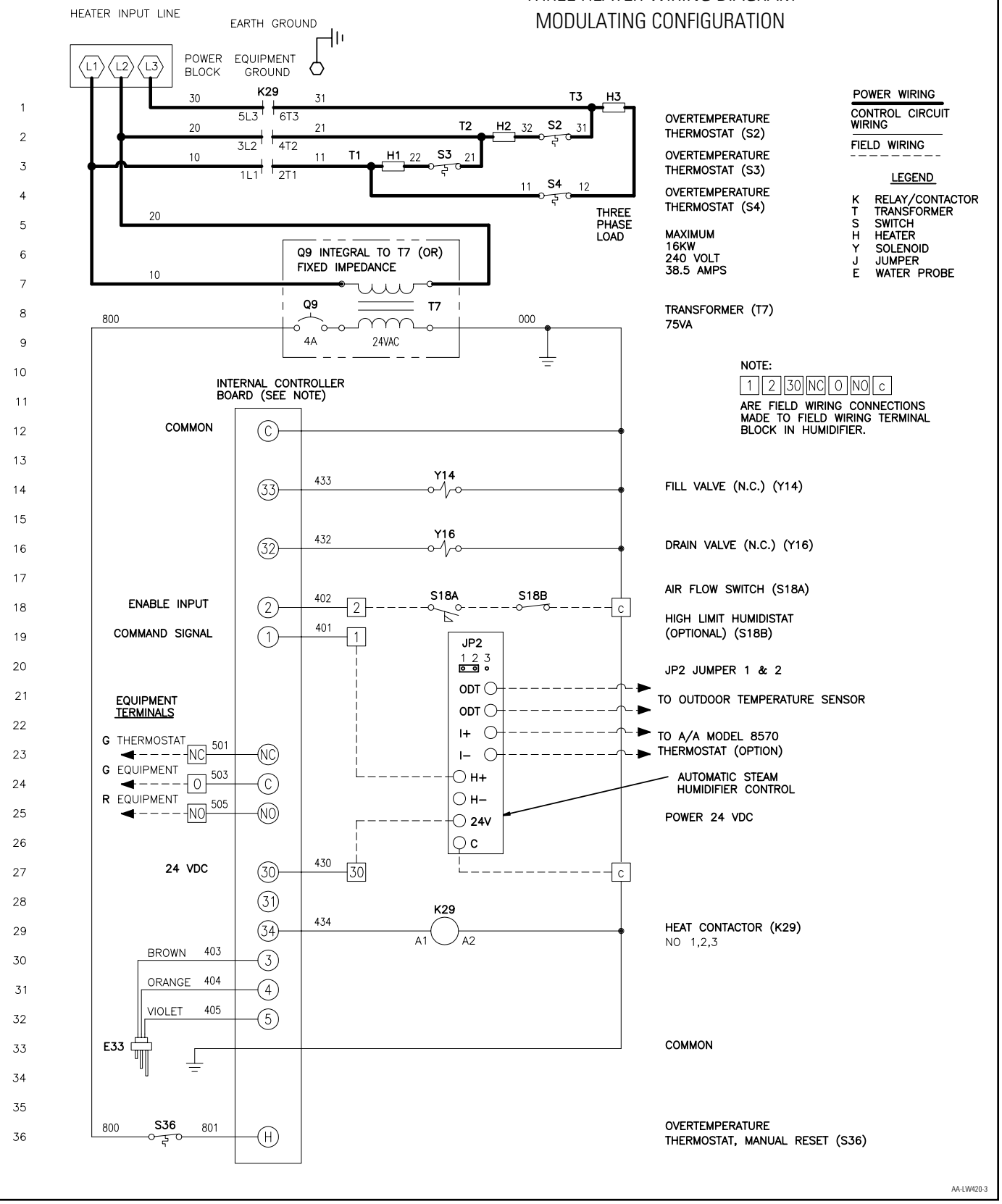


FIGURE 9 – Model 1180 Wiring Diagram



SETTING SLIDE SWITCHES

IMPORTANT: Slide switch on-off positions 1 through 16 are preset at the factory. These settings are determined by output capacity, water type, and demand signal type. Changing these settings will affect humidifier operation. Change on-off positions only per the instructions in this manual or as instructed by Aprilaire technical support staff.

On the internal controller inside the humidifier, there are two banks of slide switches. Most are set at the factory according to the model type. Others, however, must be set according to the details of each particular installation. See **Figure 10.** Note: the 'Off' slide switch position is to the left while the 'On' slide switch position is to the right. For wiring details see page 27.

Type of Control Input

Model 1150 with an on/off control: S1 slide switch positions 1 and 2 Off
Model 1160/1180 with modulating control: S1 slide switch positions 1 and 2 Off
Model 1160/1180 with 0-10 VDC signal by others: S1 slide switch positions 1 and 2 Off
Model 1160/1180 with 4-20 mA signal by others: S1 slide switch positions 1 and 2 On

Inlet water type

The controller allows autodrain settings for three water supply types:

- Normal water (hardness greater than 4 and less than 10 grains/gallon)
- Hard water (hardness greater than or equal to 10 grains/gallon)
- Softened water (hardness less than or equal to 4 grains/gallon)

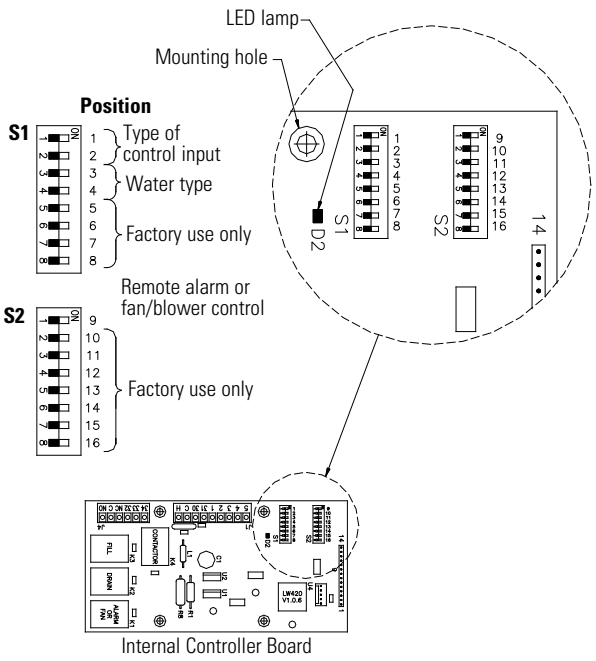
The humidifier is preprogrammed for use with normal water. If your water supply is hard or softened, follow the instructions below:

- For hard water supply (greater than or equal to 10 grains/gallon of hardness):
  – Set switch S1 position 3 to On; position 4 remains Off. See **Figure 10**.
- For softened water supply:
  – Set switch S1 position 4 to On; position 3 remains Off. See **Figure 10**.

Substituting a remote fault alarm for blower starting

The humidifier may be field programmed to send a fault alarm signal to a remote device instead of sending a signal to start the HVAC equipment blower.

FIGURE 10 – Slide Switches



Note:
Slide switches are shown in the off position.

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To enable this function, set slide switch S2 position 9 to On and provide wiring to control terminals NO, O, and NC. See **Figure 10** for slide switch positions.

If you change any on-off settings, record them in **Table 5** for future reference.

TABLE 5 – Factory Slide Switch Settings

Slide switch S1			Slide switch S2		
Position	**Factory setting**	**My setting**	**Position**	**Factory setting**	**My setting**
1	Off		9	Off	
2	Off		10	**See Table 6**	Do not change.
3	Off		11	Off	Do not change.
4	Off		12	Off	Do not change.
5	**See Table 6**	Do not change.	13	Off	Do not change.
6	Off	Do not change.	14	Off	Do not change.
7	Off	Do not change.	15	Off	Do not change.
8	Off	Do not change.	16	Off	Do not change.

Note: Positions 5-8 and 10–16 are for factory use only.

TABLE 6 – Slide Switch S1 Settings by Model

Model	Position	
	5	10
1150	Off	On
1160/1180	On	Off

CHOOSING A LOCATION FOR HUMIDIFIER COMPONENTS

Before proceeding with the installation, you must first determine where the steam distribution tube will be installed as well as the humidifier itself.

Steam Distribution Tube and Controls Location

Since this dictates the rest of the installation, first determine where the steam distribution tube will be mounted in the ductwork of the HVAC system. Refer to **Figure 12** for split system installations and **Figure 13** for rooftop unit installations. These figures also indicate where control devices are to be installed.

Absorption Distance

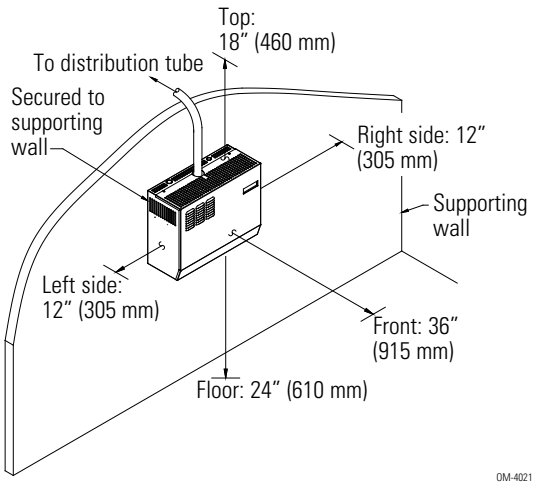
Absorption distance is the amount of open space in the duct downstream of the distribution tube required for steam to be absorbed into the air. If the duct contains obstructions such as dampers or elbows within the absorption distance, condensation on those obstructions can occur. Factors affecting absorption distance include RH of air upstream of the distribution tube, air temperature inside the duct, air velocity in the duct, and amount of moisture required. In most applications, the clear space required for absorption distance is less than 36". In fact, in many applications the absorption distance may be as short as 6". If the duct has obstructions within 36" of the distribution tube, actual absorption distance can be calculated. In applications with a large difference between the RH upstream and downstream of the distribution tube, an absorption distance greater than 36" may be required. To calculate actual absorption distance, follow the procedure listed in the **Appendix.**

Humidifier Location

When selecting the location of the humidifier, consider the following:

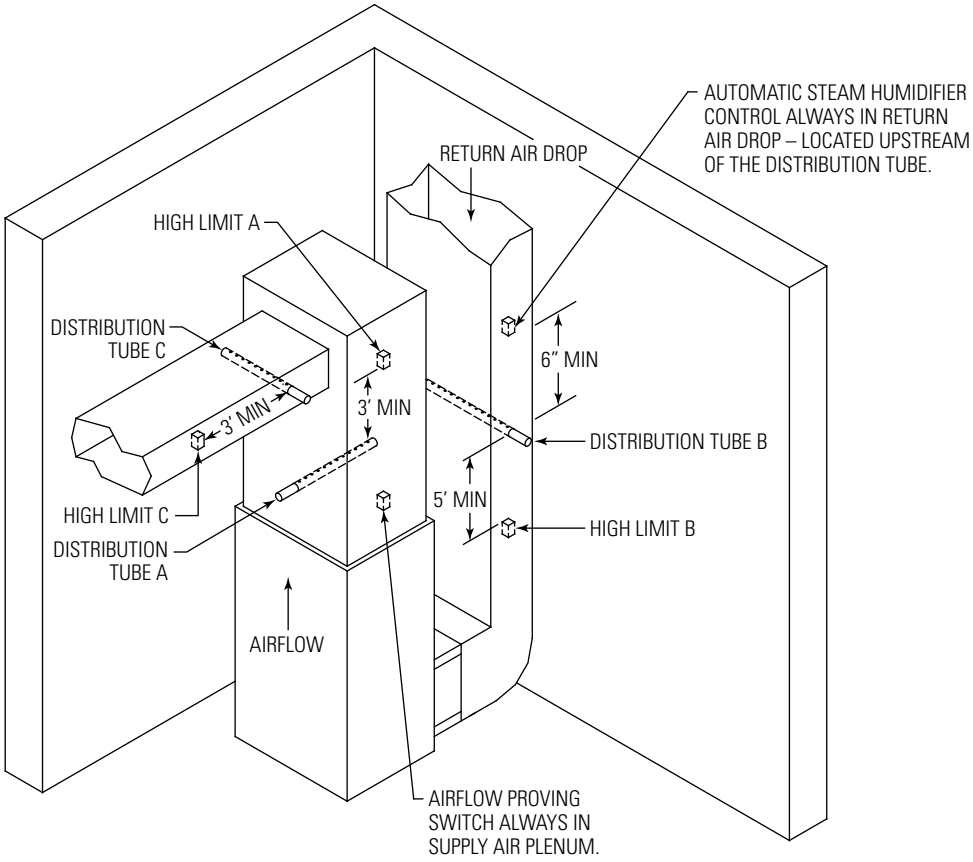
- **Ambient temperature**
  Install in locations with maximum ambient temperature of 80 °F (26.7 °C).
- **Proximity to duct**
  To avoid having to install a drain at the distribution tube in the duct, the distribution tube must be mounted at an elevation higher than the humidifier. A 10' (3 m) length of vapor hose is provided with the unit. The hose can be cut if less than 10' (3 m) is needed. The hose must have a constant downward slope from the distribution tube to the humidifier of at least 2"/ft (15%). If the distribution tube must be installed at an elevation lower than the humidifier, install a drip tee and drain as shown in **Figure 27.**
- **Required clearances** (see **Figure 11**)
- **Electrical connections**
  Electrical power supply, water supply piping, and drain piping must also be considered. **Figure 14** is a schematic illustration of the electrical and plumbing connections required. **Figure 15** shows the additional connections required in order to control the HVAC system blower with the humidifier control circuit. Electrical power supply connections are made at the upper left rear corner of the unit. The control wiring is in the upper right rear corner. Another consideration when choosing a location for the humidifier is to avoid areas close to sources of electromagnetic emissions such as power distribution transformers. Water supply piping connections are made in the lower right rear corner. Drain piping connections are made at the lower left rear corner.

FIGURE 11 – Recommended Minimum Service and Maintenance Clearances



DISTRIBUTION TUBE AND CONTROL DEVICES LOCATION OPTIONS

FIGURE 12 – Recommended Installation Locations, Split System Application



CHOOSING A DISTRIBUTION TUBE LOCATION

When installing a steam humidifier on a split system, there are three locations that can be used to mount the steam distribution tube: the supply plenum (Location A), the return duct (Location B), or a supply branch (Location C).
Note: Wherever distribution tube is installed, there must be a minimum of 4.5" between top of tube and the duct ceiling. Refer to **Figures 16 and 17** on page 23.

Location A is the best choice because:
- The distribution tube is humidifying 100% of the air, and
- The supply air temperature is typically warmer than the return air temperature, allowing for better absorption.

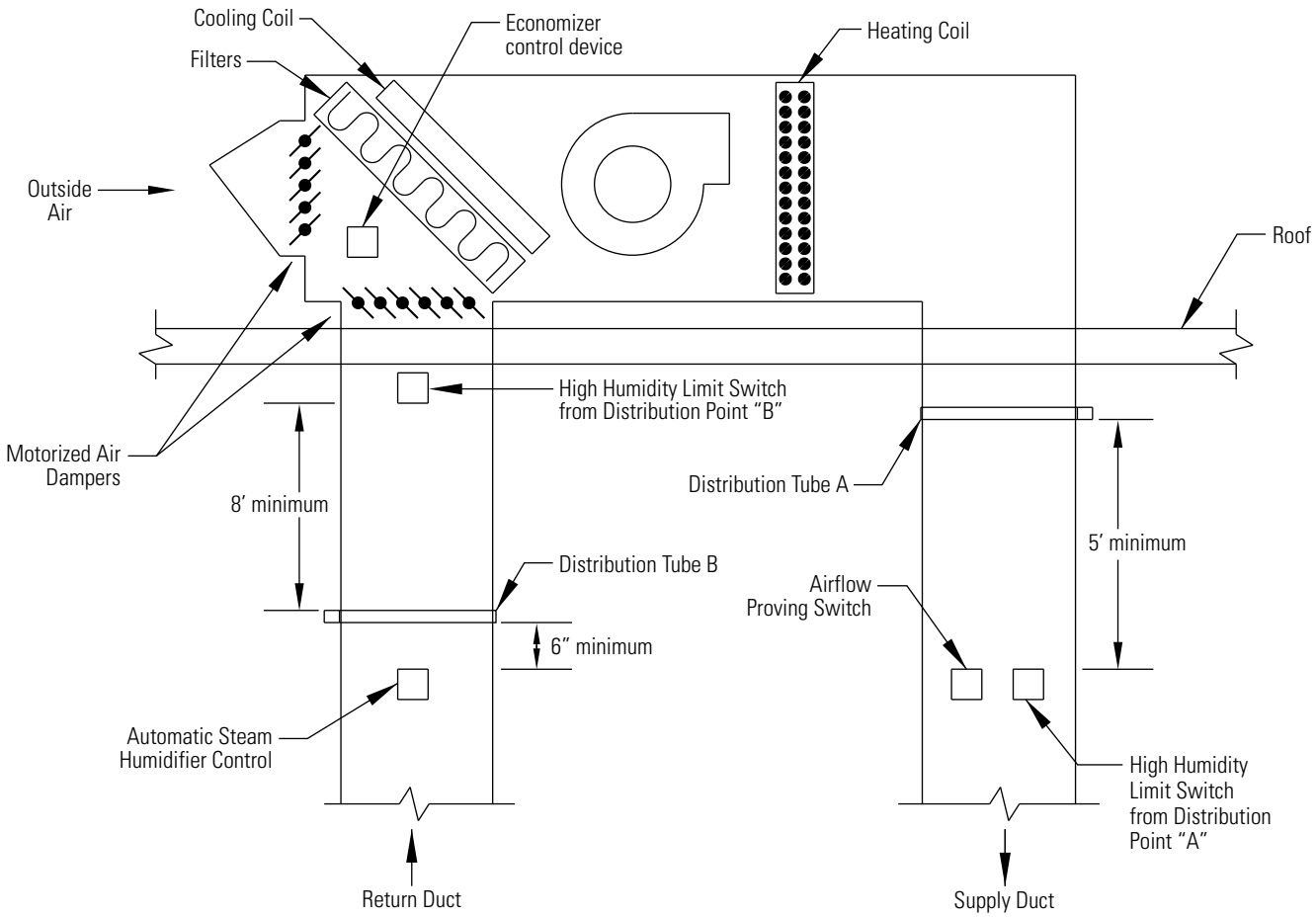
Location B is the second choice because the distribution tube is humidifying 100% of the air, but the cooler temperature of the return air requires more space for absorption.

Location C should be the last choice because, in most cases, there is more than one branch off the supply air plenum, and less than 100% of the air would be humidified in such a multi-branch system. However, **if there is only one branch, the Location C would be considered equal to Location A** because the same reasons listed under Location A would apply.

Choosing control device locations
- Install the high humidity limit switch (a recommended optional device) a minimum of 5' (1.5 m) downstream of the distribution tube.
- Install the Automatic Steam Humidifier Control in the return air drop a minimum of 6" upstream of the distribution tube.
- Install the airflow proving switch in the supply air plenum.

OM-4016

FIGURE 13 – Placing a Distribution Assembly in a Rooftop Air Handler Application



CHOOSING A DISTRIBUTION TUBE LOCATION

When installing a steam humidifier on a packaged rooftop unit application, there are two locations that can be used to mount the steam distribution tube: supply plenum/duct (Location A) or the return plenum/duct (Location B). **Note:** Wherever distribution tube is installed, there must be a minimum of 4.5" between top of tube and the duct ceiling. Refer to **Figures 16 and 17** on page 23.

Location A is the best choice because:

- The distribution tube is humidifying 100% of the air.
- The supply air temperature is typically higher than the return air temperature, allowing for better absorption of the steam.

Note: In applications using zone control products, the distribution tube must be installed upstream of all zone control dampers to ensure that all zones receive humidified supply air.

Choosing control device locations

- Install the high humidity limit switch (a recommended optional device) a minimum of 5' (1.5 m) downstream of the distribution tube.
- Install the Automatic Steam Humidifier Control in the return air duct a minimum of 6" upstream of the distribution tube.
- Install the airflow proving switch in the supply air plenum.

OM-4043

FIGURE 14 – Steam Humidifier Wiring and Utility Diagram

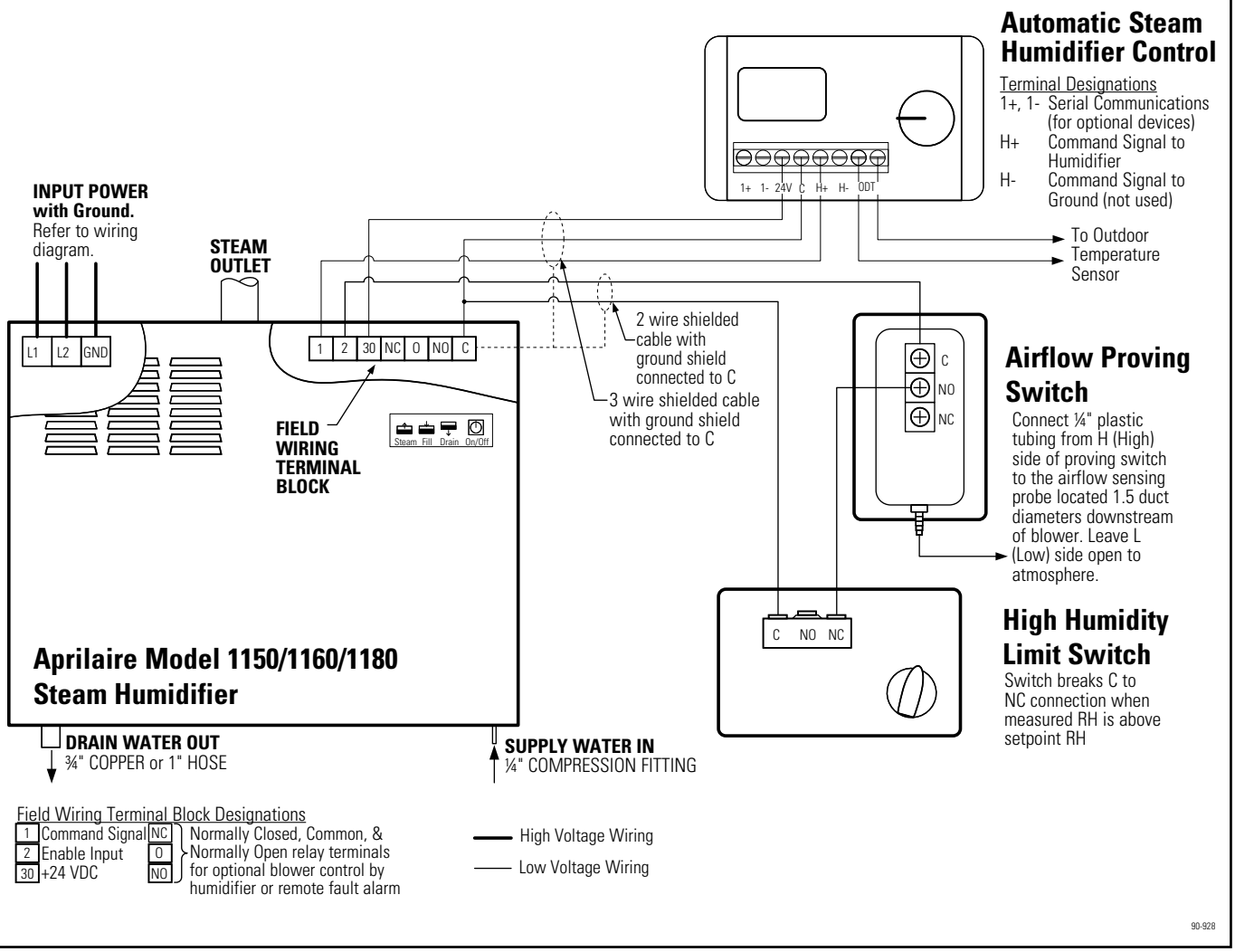
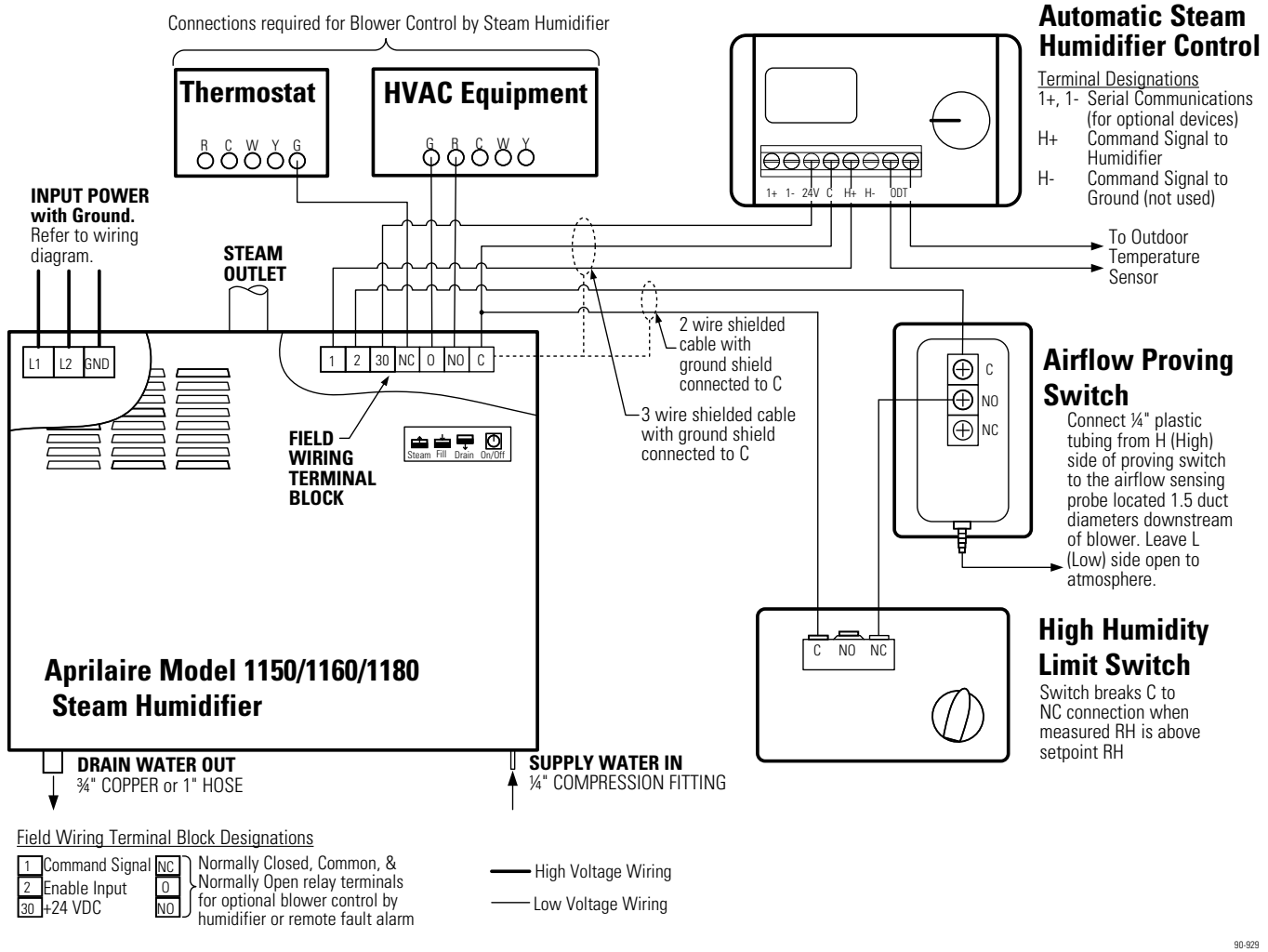

Automatic Steam Humidifier Control
Terminal Designations
1+, 1- Serial Communications (for optional devices)
H+ Command Signal to Humidifier
H- Command Signal to Ground (not used)
1+ 1- 24V C H+ H- ODT
To Outdoor Temperature Sensor
INPUT POWER with Ground.
Refer to wiring diagram.
L1 L2 GND
STEAM OUTLET
1 2 30 NC O NO C
2 wire shielded cable with ground shield connected to C
3 wire shielded cable with ground shield connected to C
FIELD WIRING TERMINAL BLOCK
Steam Fill Drain On/Off
C NO NC
Airflow Proving Switch
Connect ¼" plastic tubing from H (High) side of proving switch to the airflow sensing probe located 1.5 duct diameters downstream of blower. Leave L (Low) side open to atmosphere.
C NO NC
High Humidity Limit Switch
Switch breaks C to NC connection when measured RH is above setpoint RH
Aprilaire Model 1150/1160/1180 Steam Humidifier
DRAIN WATER OUT
¾" COPPER or 1" HOSE
SUPPLY WATER IN
¼" COMPRESSION FITTING
Field Wiring Terminal Block Designations
1 Command Signal
2 Enable Input
30 +24 VDC
NC O NO Normally Closed, Common, & Normally Open relay terminals for optional blower control by humidifier or remote fault alarm
High Voltage Wiring
Low Voltage Wiring
90-928

FIGURE 15 – Steam Humidifier Wiring and Utility Diagram with Blower Control by Humidifier


Connections required for Blower Control by Steam Humidifier
Thermostat
R C W Y G
HVAC Equipment
G R C W Y
Automatic Steam Humidifier Control
Terminal Designations
1+, 1- Serial Communications (for optional devices)
H+ Command Signal to Humidifier
H- Command Signal to Ground (not used)
1+ 1- 24V C H+ H- ODT
INPUT POWER with Ground. Refer to wiring diagram.
L1 L2 GND
STEAM OUTLET
To Outdoor Temperature Sensor
1 2 30 NC O NO C
2 wire shielded cable with ground shield connected to C
3 wire shielded cable with ground shield connected to C
FIELD WIRING TERMINAL BLOCK
Steam Fill Drain On/Off
C NO NC
Airflow Proving Switch
Connect ¼" plastic tubing from H (High) side of proving switch to the airflow sensing probe located 1.5 duct diameters downstream of blower. Leave L (Low) side open to atmosphere.
C NO NC
High Humidity Limit Switch
Switch breaks C to NC connection when measured RH is above setpoint RH
Aprilaire Model 1150/1160/1180 Steam Humidifier
DRAIN WATER OUT
¾" COPPER or 1" HOSE
SUPPLY WATER IN
¼" COMPRESSION FITTING
Field Wiring Terminal Block Designations
1 Command Signal
2 Enable Input
30 +24 VDC
NC O NO
Normally Closed, Common, & Normally Open relay terminals for optional blower control by humidifier or remote fault alarm
High Voltage Wiring
Low Voltage Wiring
90-929

DISTRIBUTION TUBE INSTALLATION

After the location for the distribution tube has been identified, follow the steps below and refer to **Figure 16** to install the distribution tube in the duct.

1. Cut or drill a 1 5/8" diameter opening in the duct for 1150/1160; 2 1/8" for 1180.
2. Drill a 3/8" hole in the opposite surface of the duct so that the distribution tube has a 2"/ft. (15%) pitch, sloping back towards the humidifier. The distribution tube is to be positioned in the duct such that 1 1/2" – 3 1/2" of the tube is extending out of the duct for attachment of the steam hose.
3. Use a 3/8"-16 mounting bolt, 3/8" lock washer, and 3/8" flat washer (included) to secure the end of the tube to the far side of the duct.
4. If the duct is wider than the distribution tube, attach a 3/8"-16 threaded rod cut to the appropriate length (not provided) to the end of the tube. Secure end of threaded rod with (2) 3/8"-16 nuts and washers. See **Figure 17.**
5. Orient distribution tube so that tubelets (steam orifices) point up. To help verify this, on the section of tube that will be sticking outside of the duct, mark a spot that is in line with the tubelets. If airflow is straight downward, orient distribution tube so the steam orifices do not face directly into the air stream. Do not orient distribution tube so orifices are angled down.
6. If the distribution tube is shorter than the duct width causing the steam tubelets to be outside the duct, plug the exposed tubelet openings with silicon caulk.
7. Attach each of the two halves of the face plate to the duct using sheet metal screws, fitting the face plates tightly against the distribution tube.
8. Seal any gaps around face plates using silicon caulk.

CAUTION

The hose must have a minimum pitch of 2"/ft. (15%) from the distribution tube back to the humidifier. If not possible due to obstructions or duct configuration, a drip tee and drain must be installed. See **Figure 27** on page 32. Failure to follow these recommendations can result in excessive back pressures on the humidifier. This may lead to distribution tube spitting, steam blowing through the P-trap before the plumbing system, or leaking gasket.

WARNING

Distribution tube, steam hose, tubing or hard pipe may contain steam, and surfaces may be hot. Discharged steam is not visible. Contact with hot surfaces or air into which steam has been discharged may cause severe personal injury.

FIGURE 16 – Distribution Tube Installation

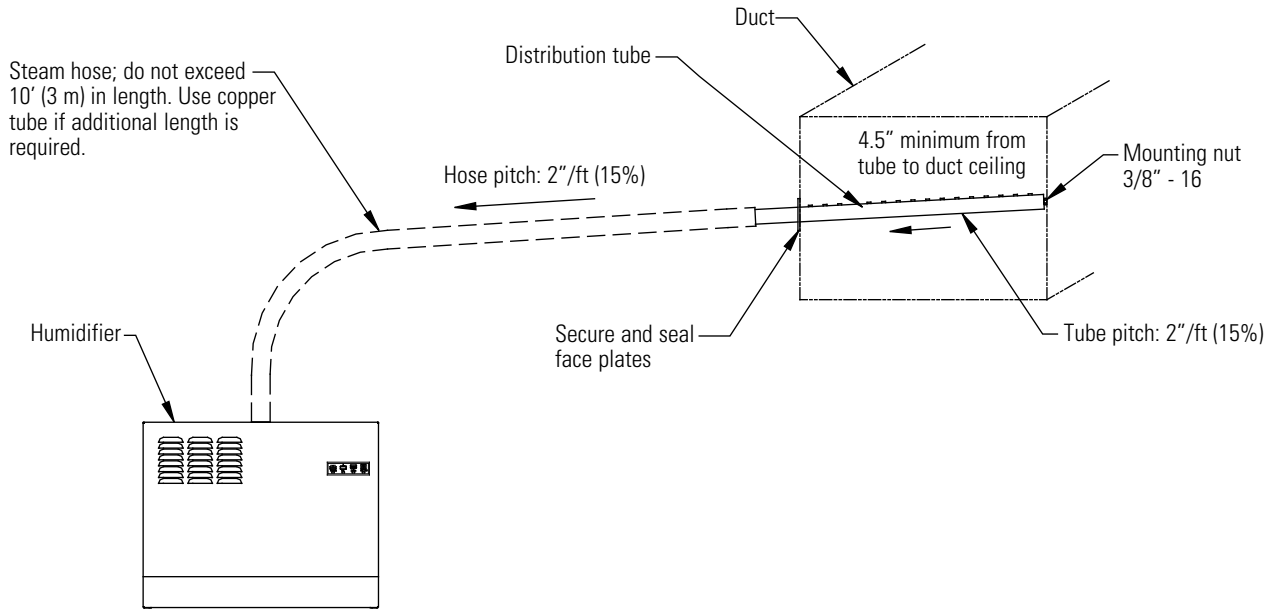
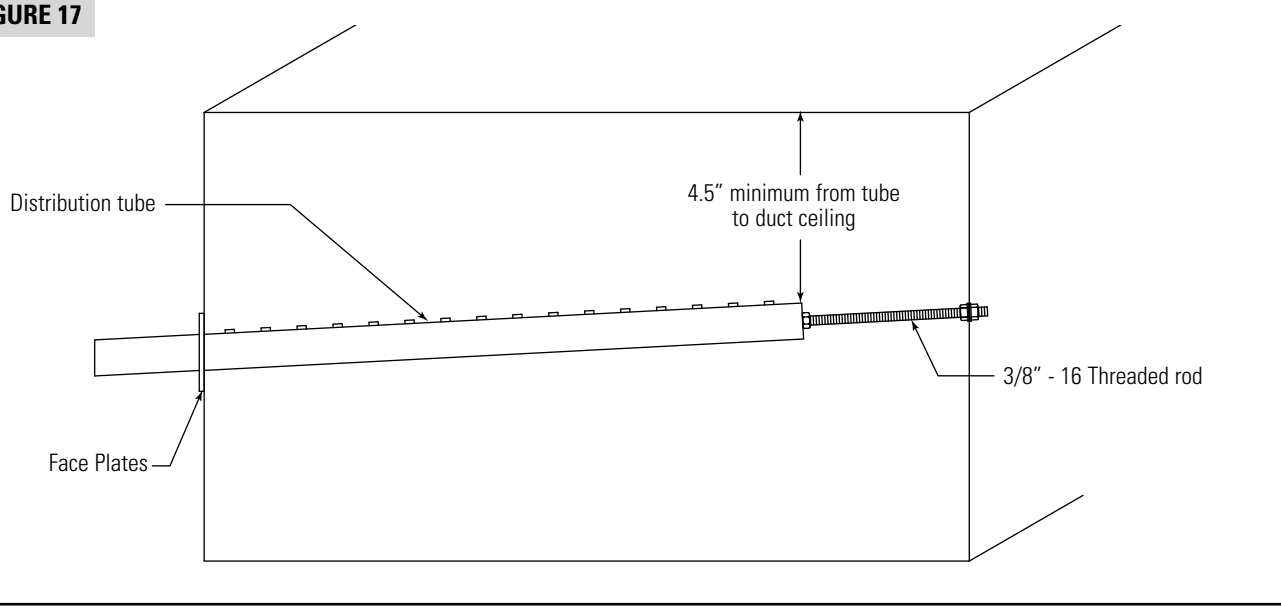

Duct
Distribution tube
Steam hose; do not exceed 10' (3 m) in length. Use copper tube if additional length is required.
4.5" minimum from tube to duct ceiling
Mounting nut 3/8" - 16
Hose pitch: 2"/ft (15%)
Humidifier
Secure and seal face plates
Tube pitch: 2"/ft (15%)
OM-4008

FIGURE 17



MOUNTING THE HUMIDIFIER

Mounting the humidifier on the wall

When mounting on a wood stud wall (studs 16" [406 mm] on center), locate studs and position lag bolts in place so that each of the bolts centers on a stud. Mark hole locations and predrill ¼" (6 mm) diameter pilot holes. Secure cabinet to wall with lag bolts provided.

When mounting on a metal stud wall, locate the studs (16" [406 mm] on center) and drill a 3/8" (10 mm) hole through the studs and wall. Push a 3/8" (10 mm) bolt through the wall, studs, and a backing plate on the backside of the wall and secure with a nut and washer.

If 16" (406 mm) on-center studs are not available, mount spanner boards on the wall, spanning two studs. If two horizontal boards are used, locate one at the top of the cabinet for the lag bolts and the other board located 3" (76 mm) on center from the bottom of the cabinet.

For hollow block or poured concrete wall mounting, mark holes 16" apart. Drill appropriate pilot holes for two 3/8" (10 mm) toggle bolts or two 3/8" (10 mm) machine bolt lead anchors. Secure cabinet in place.

When suspending the unit from ceiling or roof structural members

Required Parts:

Hanging bracket kit, P/N 4593 includes:
- 2 Mounting brackets
- 4 Bolts, 1/4 - 20, 3/4 long , plated.
- 4 Nylon insert nuts, 1/4 - 20
- 8 Flat Washers, 1/4 -20, plated (thin washers)
- 8 Washers, 1/4 -20, plated

4 Threaded Rods, 3/8 - 16 (length depends on installation specifics. Not provided.)

Procedure:

1. Remove the shroud covering of the humidifier.
2. Insert the first bolt through the side slot farthest to the rear of the humidifier. Follow the "Fastener Sequence" listed below, ensuring the bolt head is on the inside of the humidifier frame.
3. Repeat the "Fastener Sequence" for the humidifiers vertical side slot located toward the front.
   NOTE: The metal of the frame will need to be flexed in order to insert the left front bolt.
4. Repeat steps 2 & 3 for the other side.
5. Use four lengths of 3/8 inch threaded rod to suspend the humidifier. Observe all applicable codes and standards.

Fastener Sequence:

Starting from the inside of the humidifier:

Bolt, flat washer, through the vertical slots on the side of the humidifier frame, 1/4-20 washer, 1/4-20 washer, Bracket (use the small holes the same side as the slots), flat washer, Nylon insert nut.

INSTALL STEAM HOSE

Attach one end of the steam hose to the distribution tube and the other end to the humidifier. Secure with hose clamps at both ends. Ensure that a minimum pitch of 2"/ft (15%) is maintained along length of hose. If pitch is not possible, it will be necessary to install a tee fitting and p-trap. Refer to **Figure 27** on page 32 for details. If the 10' hose is not long enough to reach from the humidifier to the distribution tube, use 1-1/2" copper tubing (Model 1150/1160), or 2" copper tubing (Model 1180).

FIELD WIRING

Humidifier field wiring

All wiring must be in accordance with all governing codes and with the humidifier wiring diagram. Wiring diagrams are on pages 12, 13 and 14 in this manual and the wiring diagram for your humidifier model is located inside the removable shroud. Power supply wiring must be rated for 221°F (105°C). The maximum ambient temperature is 80°F (27°C).

Field wiring connections and requirements

- Conduit knockouts are provided on the top of the cabinet. Control wiring knockouts are on the back right; power wiring knockouts are on the back left.
- Control wiring and power wiring must be run in dedicated or separate earthed metal conduit, cable trays, or trunking.
- Separate the line voltage wiring from low voltage control circuit wiring when routing electrical wiring inside the humidifier cabinet.
- Do not use chassis or safety grounds as current-carrying commons. Never use a safety ground as a conductor or neutral to return circuit current.

CAUTION

Adding alternate conduit connections should not be necessary; however, when making holes and knockouts in the humidifier cabinet, protect all internal components from debris and vacuum out cabinet when finished. Failure to comply with this warning can damage sensitive electronic components and void the Aprilaire warranty.

Below are field wiring connections:

- **Connect to line power.**
  Refer to the wiring diagram or the dataplate on the outside of the cabinet for wire sizing amperage.
- **Connect to control signal wiring.**
  (from the Automatic Steam Humidifier Control or from signal by others). Mount the Automatic Steam Humidifier Control in the return air duct as shown in **Figure 12** on page 18 and **Figure 13** on page 19. See pages 27-28 for wiring details. Also, refer to the Installation and Operating Manual for the Automatic Steam Humidifier Control.
- **Connect to the HVAC system blower.**
  To start the HVAC equipment blower when the humidifier receives a humidity demand signal, wire the NO, O, and NC control terminals to the HVAC system as shown on the wiring diagram.
- **Connect to a remote fault alarm (optional).**
  The humidifier may be field programed to send a fault alarm signal to a remote device instead of sending a signal to start the HVAC system blower. To enable this function, set slide switch S2 position 9 to On and provide wiring to control terminals NO, O, and NC.
- **Connect to the duct airflow proving switch wiring.**
  The airflow proving switch is a safety device that will prevent the humidifier from producing steam when there is no airflow present in the HVAC system. See page 29 for details.
- **Connect to the duct high humidity limit switch wiring (a recommended optional device).**
  Locate the duct high humidity limit switch the correct distance downstream of the distribution tube. See **Figure 12** on page 18 and **Figure 13** on page 19 for more location guidelines.

  IMPORTANT: Installation of a duct high humidity limit switch is highly recommended.

WARNING Line voltage may cause serious injury or death from electrical shock. Shut off power at main breaker before installing supply wiring for humidifier.

WARNING Failure to properly ground unit may result in property damage due to fire, or serious injury or death from electrical shock.

LINE POWER

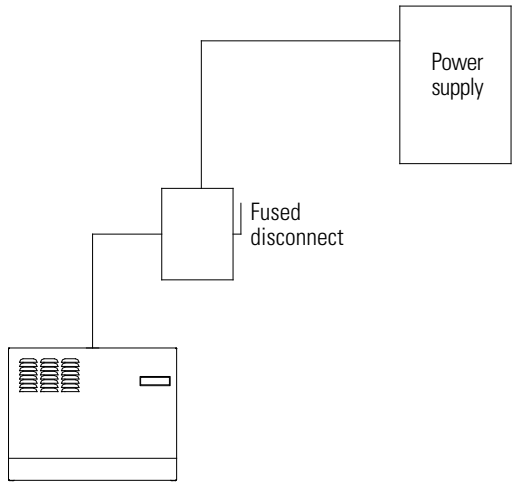
The 1150/1160 humidifier is designed for 240 VAC, single phase, 50/60 Hz input power. The Model 1150 requires a 25 amp (minimum) breaker while the Model 1160 requires a 45 amp (minimum) breaker. The Model 1180 is designed for 240 VAC, three phase, 50/60 Hz input power. The Model 1180 requires a 50 amp (minimum) breaker. Install a fused quick disconnect box nearby the humidifier for easy access during maintenance of humidifier. See **Figure 18.**

208 VAC, 50/60 Hz input power may also be used. Note that when using 208 VAC the steam capacity of each unit will be reduced by approximately 25% compared to rated capacity at 240 VAC.

Line power grounding requirements

The ground connection must be made with solid metal to metal connections. The ground must be a good radio frequency earth. Ground wire should be the same size as power wiring.

FIGURE 18 – Line Power Wiring Requirements



CONTROL WIRING

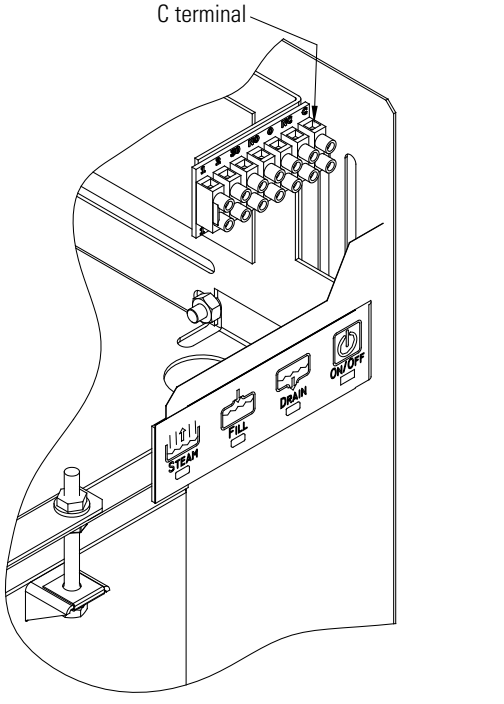
Proper control wiring prevents electrical noise.

Electrical noise can produce undesirable effects on electronic control circuits, which affects controllability. Electrical noise is generated by electrical equipment such as inductive loads, electric motors, solenoid coils, welding machinery, or fluorescent light circuits. The electrical noise or interference generated from these sources (and the effect on controllers) is difficult to define, but the most common symptoms are erratic control or intermittent operational problems.

IMPORTANT

- For maximum electromagnetic compatibility effectiveness, wire all humidity, high limit, and airflow controls using multicolored shielded plenum-rated cable with a ground wire for the shield. Connect the ground wire to the C terminal on the field wiring terminal block in the humidifier. See **Figure 19.** Use wire less than 2" (50 mm) in length for the shielded cable ground wire.
- Do not ground shield at the device end.

FIGURE 19 – Shielded Cable Wire Connection to C Terminal



Control input wiring

The internal controller offers four input control types, which are field adjustable. The factory default control type for Model 1150 is the Automatic Steam Humidifier Control, on-off configuration as shown in **Figure 20**.

The factory default control type for Model 1160/1180 is the Automatic Steam Humidifier Control, modulating configuration as shown in **Figure 21**.

IMPORTANT: For Model 1150 on/off control, verify that the shunt on the JP2 jumper is placed over the 2 & 3 position. For Model 1160/1180 modulating control, verify that the shunt on the JP2 jumper is placed over the 1 & 2 position.

To change the input control type on Model 1160/1180 to signal by others, see **Figure 22** for a 0-10 VDC signal, and see **Figure 23** for a 4-20 mA signal (input resistance 250 ohms).

IMPORTANT: Note the internal controller slide switch S1 settings in each control input wiring diagram.

FIGURE 20 – Model 1150: Input Wiring for Automatic Steam Humidifier Control (on/off configuration)

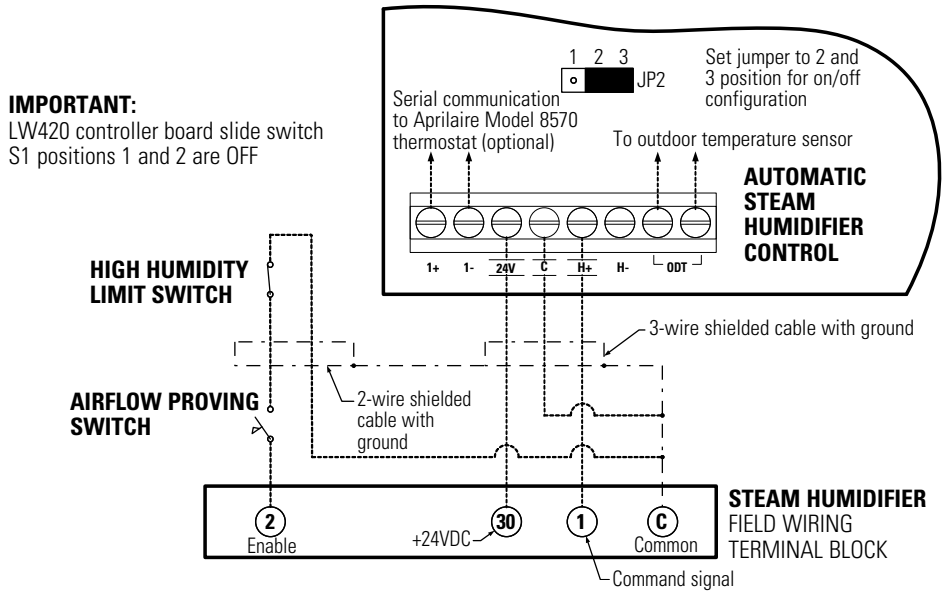


FIGURE 21 – Model 1160/1180: Input Wiring for Automatic Steam Humidifier Control (modulating configuration)

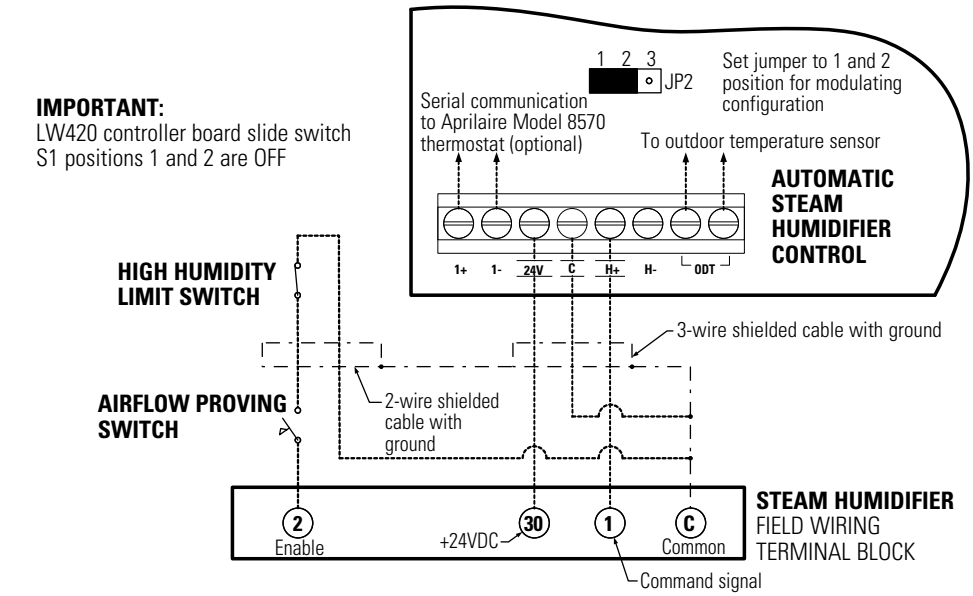


FIGURE 22 – Model 1160/1180: Input Wiring for Optional 0-10 VDC Signal by Others

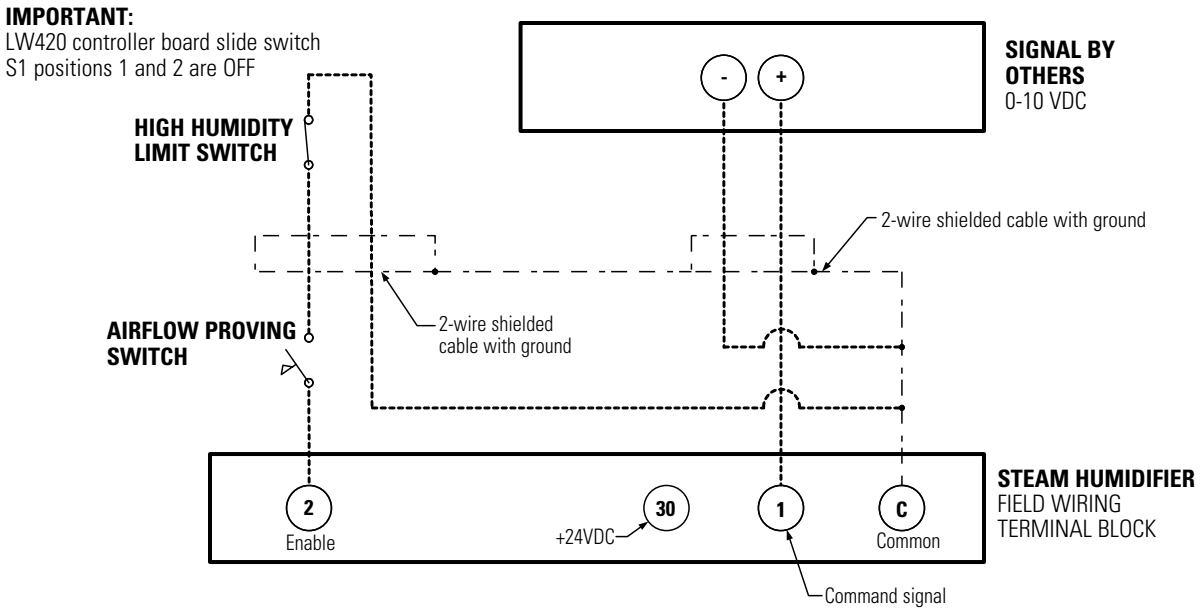
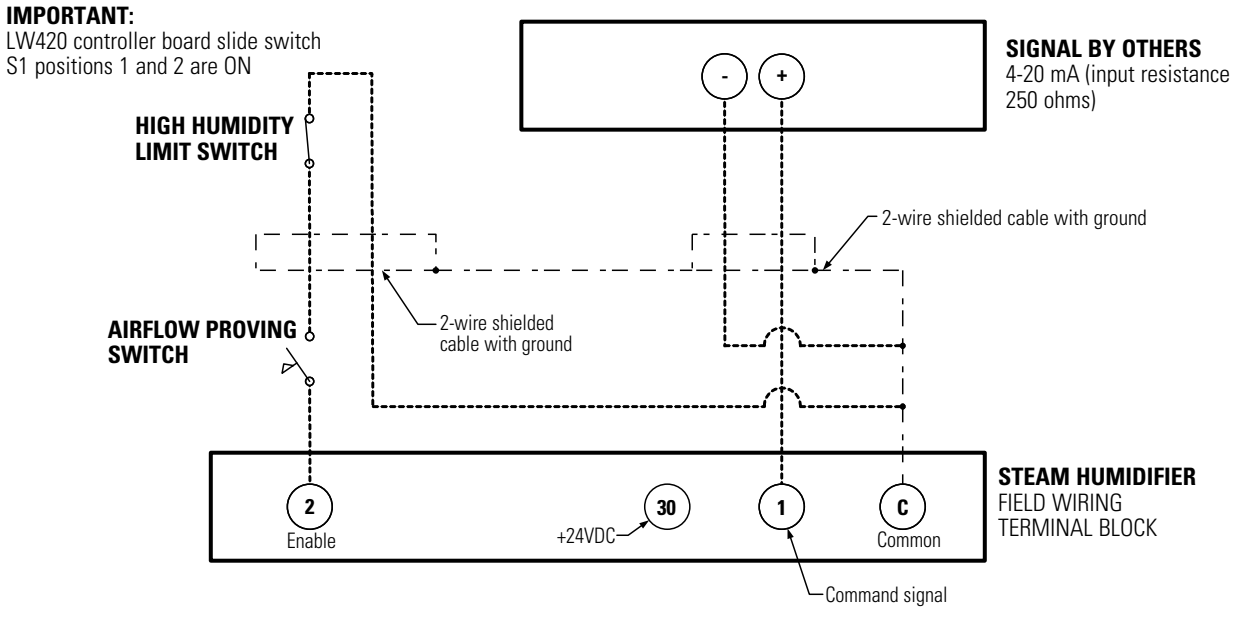


FIGURE 23 – Model 1160/1180: Input Wiring for Optional 4-20 mA Signal by Others

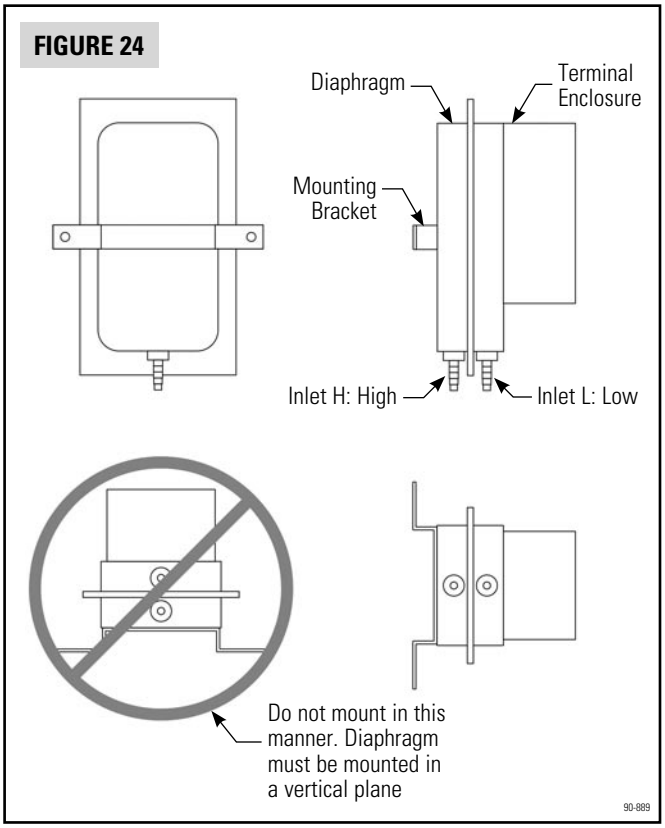


AIRFLOW PROVING SWITCH INSTALLATION INSTRUCTIONS

Description:

The airflow proving switch is a safety device that will prevent the humidifier from producing steam when there is no airflow present in the HVAC system. The switch is a pressure differential measuring device that determines if there is airflow present based on the pressure differential between the HVAC system and atmosphere. The switch contains a diaphragm, calibration spring, and a snap acting SPDT switch. See **Figure 24** for details.

FIGURE 24



Operation:

When the HVAC equipment fan is off, the airflow proving switch is open. In the event of a demand "call" from the humidistat in this state, the airflow proving switch would prevent the humidifier from starting or producing steam.

When the airflow proving switch senses that the HVAC equipment fan is on, the switch closes. This position will allow the humidifier to come on and produce steam.

Installation:

The airflow proving switch is mounted on any surface free from vibration. The airflow proving switch must be installed with the diaphragm in a vertical plane. (See **Figure 24** for acceptable and unacceptable mounting configurations.) Avoid mounting the switch with the inlet line connections facing up.

The air sampling probe (included) must be located a minimum of 1.5 duct diameters downstream from the discharge of the HVAC equipment blower. It is connected to the airflow proving switch by a 1/4" field supplied plastic tubing. The hose is connected to inlet H on the switch housing, while inlet L remains open to the atmosphere. (See **Figure 24**).

Using the 'Normally Open' and 'Common' terminals inside the terminal enclosure, wire the airflow proving switch to the field wiring terminal block in the humidifier according to the wiring diagram depending on the humidifier model number. See **Figures 20-23** on pages 27-28.

The airflow proving switch is field adjustable from .05" w.c. to 12" w.c.. To adjust the set point, turn the adjusting screw counter clockwise (CCW), until motion has stopped. Next, turn the adjusting screw 4 complete turns in a clockwise direction to engage the spring. From this point, the next 10 turns will be used for calibration. The optimum setting is one that will only close the switch when the fan is in operation. Each full turn of the adjustment screw represents approximately 1.2" w.c.

To properly calibrate an airflow proving switch, a digital manometer or other pressure measuring device should be used to confirm the actual set point.

SUPPLY WATER AND DRAIN PIPING

The humidifier is designed to operate with hot or cold, hard or soft water. Be sure to set slide switches on the internal controller board to guidelines on page 15. Supply water piping may be of any code-approved material (copper, steel, or plastic). The fill valve connection size is a ¼" (DN8) compression fitting. In cases where water hammer may be a possibility, consider installing a shock arrestor. Water pressure must be between 25 psi and 80 psi (175 kPa and 550 kPa).

Drain piping may be of any code-approved material (copper, steel, or plastic rated for 212°F [100°C] minimum). If drainage by gravity is not possible, use a reservoir pump rated for 212°F (100°C) water.

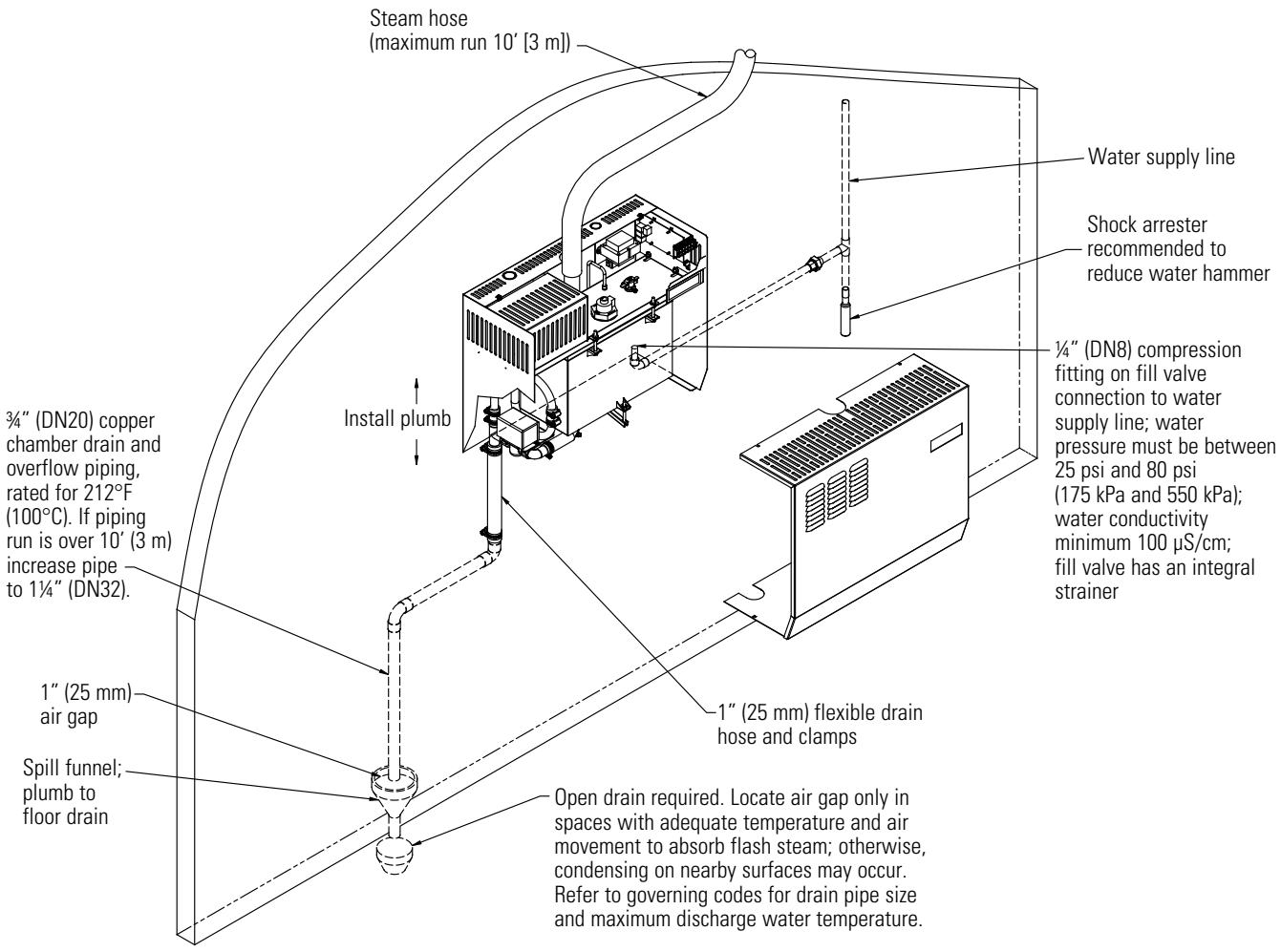
The final connection size is 1" (DN25) hose or ¾" (DN20) copper for the chamber drain. Do not reduce this connection size. (See **Figures 25** and **26** for proper drain piping configurations.)

A 12" (305 mm) piece of 1" (DN25) hose is provided to function as the flexible connection from the drain valve to the field installed drain plumbing. The flexible connection provides a disconnect point so that the chamber can be removed for cleaning. (See **Figure 25**).

Hard piping can be connected directly to the drain valve, but the vertical drop should be minimized prior to a horizontal run. Install a union at the beginning of the horizontal run to remove the chamber for cleaning. (See **Figure 26**).

If the equivalent length of pipe from the humidifier drain to the plumbing system drain is more than 10' (3 m), increase the pipe size to 1¼" (DN32). See **Figures 25** and **26.**

FIGURE 25 – Field Piping Overview Showing Hose Drain Connection



Notes:
- Dashed lines indicate provided by installer.
- The water supply inlet is more than 1" (25 mm) above the skim/overflow port, eliminating the possibility of backflow or siphoning from the chamber. No additional backflow prevention is required; however, governing codes prevail.

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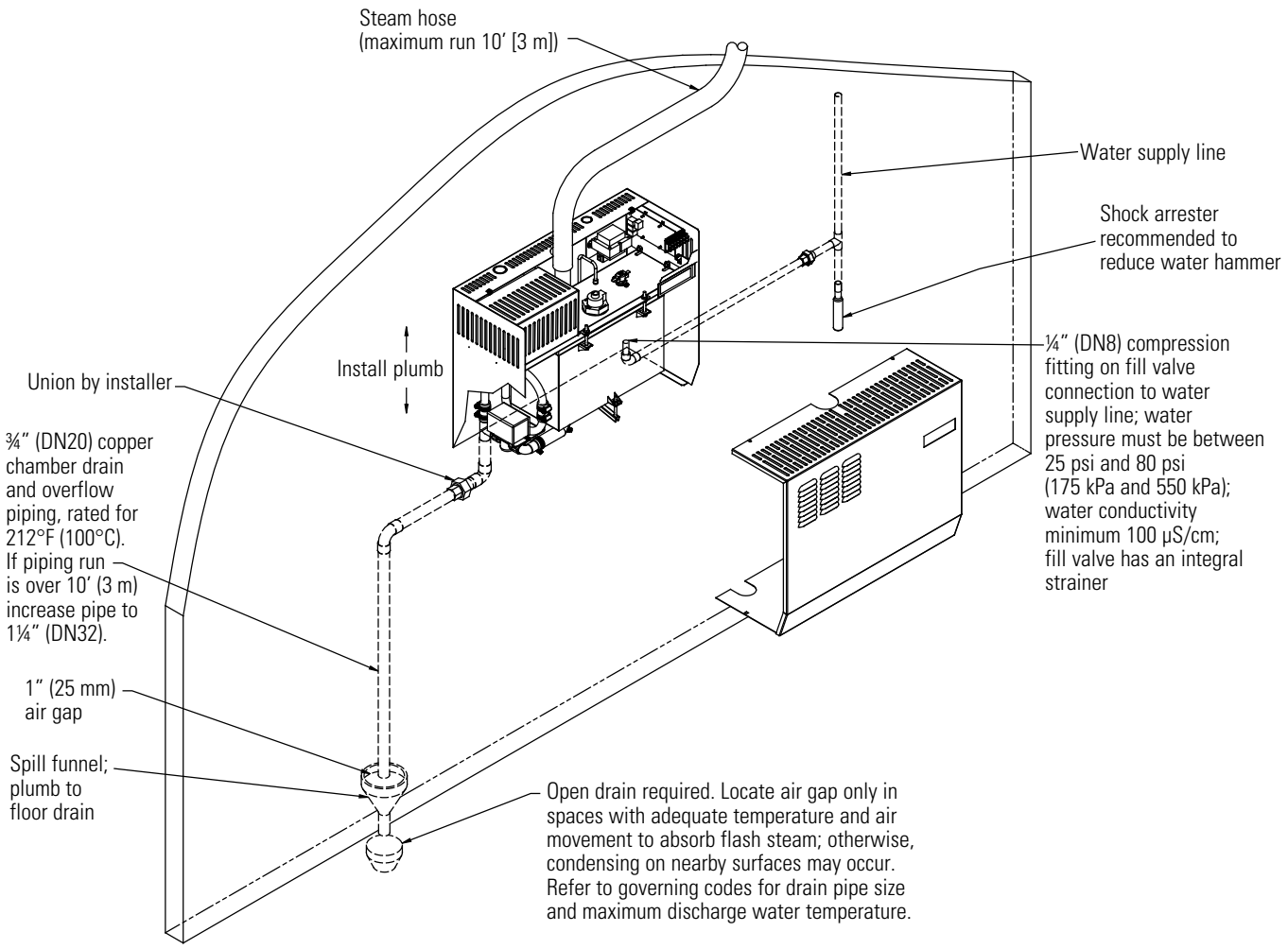
FIGURE 26 – Field Piping Overview Showing Hard Pipe Drain Connections



Notes:

- Dashed lines indicate provided by installer.
- The water supply inlet is more than 1" (25 mm) above the skim/overflow port, eliminating the possibility of backflow or siphoning from the chamber. No additional backflow prevention is required; however, governing codes prevail.

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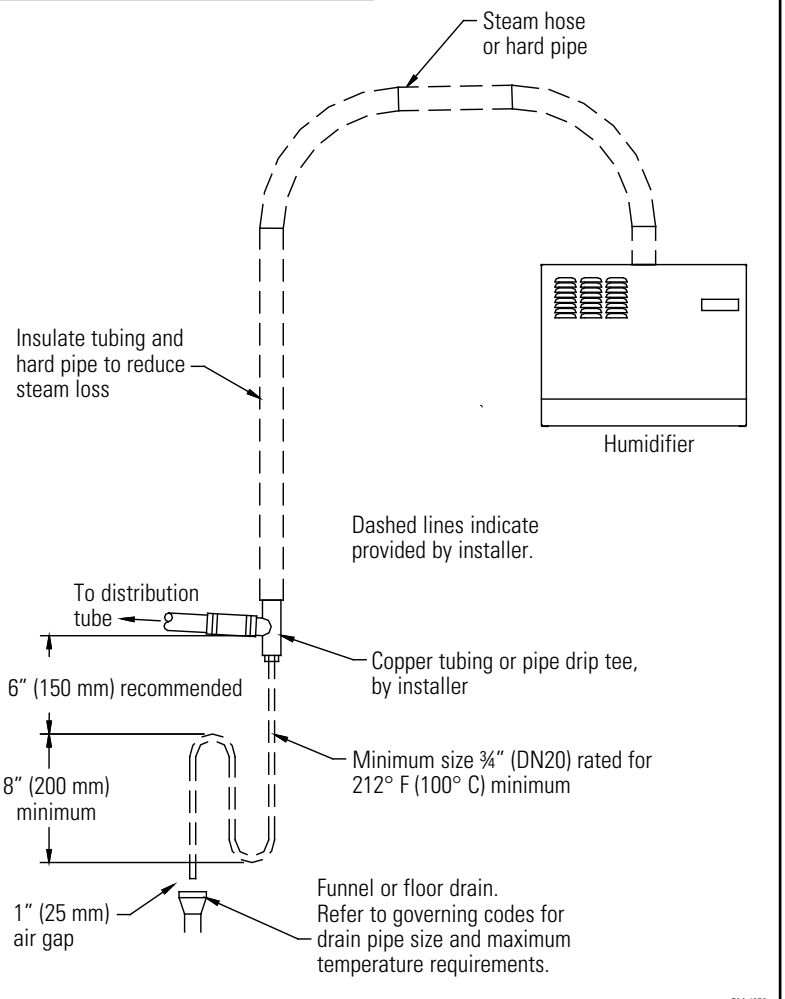
DISTRIBUTION DRIP TEE INSTALLATION

If the humidifier cannot be mounted below the steam distribution tube, such that there is a minimum 2"/ft (15%) pitch along the entire hose length, a drip tee as shown below must be installed. Failure to follow the recommendations on this page, when the humidifier is mounted higher than the distribution tube, can result in excessive back pressures on the humidifier. This may lead to distribution tube spitting, steam blowing through the P-trap before the plumbing system, or leaking gasket.

IMPORTANT: Steam hose must be supported to prevent sagging or low spots.

FIGURE 27 – Drip Tee Installation



OPERATION

HUMIDIFIER START-UP PROCEDURE

WARNING Line voltage may cause serious injury or death from electrical shock. Do not remove the power/ heater terminal cover until electrical power is disconnected. Only qualified electrical personnel should perform start-up procedure.

After the system is properly installed and connected to both electrical and water supplies, it can be started.

START-UP PROCEDURE:

Steam Chamber

Before filling with water, check mounting to verify that the steam chamber is level and securely supported.

Piping

Verify that all piping connections are completed as recommended and that water pressure is available.

Use cold or hot supply water. If the water pressure is above 60 psi (415 kPa) and/or water hammer is excessive, install a pressure-reducing valve or shock arrester. Even though the humidifier has an internal 1" (25 mm) air gap, some governing codes may require backflow prevention.

IMPORTANT: Minimum water supply pressure is 25 psi (175 kPa).

Electrical

Before start-up, verify that electrical connections have been made per governing codes and the wiring requirements listed in this manual.

- Verify that all power terminal screws and lugs are tight from power block to heaters. See **Table 7** for torque specifications.
- Verify that the transformer, drain valve, fill valve, and contactor electrical plugs located under the humidifier shroud are completely plugged in.
- Confirm the internal controller board slide switch S1 and S2 positions marked 1 through 16 are in the correct on or off position.

TABLE 7 – Torque Specifications

Screw or lug location		Torque	
		inch-lbs	Nm
Power block		16	1.8
Contactor or Relay		16	1.8
Heater nut	8-32 nut (8.5 mm)	20	2.2
	10-32 nut (9.5 mm)	25	2.8
Heater wire lug	6 gauge wire (10 mm^2)	35	4.0
	8 gauge wire (6 mm^2)	25	2.8
	10-14 gauge wire (<6 mm^2)	20	2.2

Water Supply

- Turn water supply on; confirm drain valve is closed.

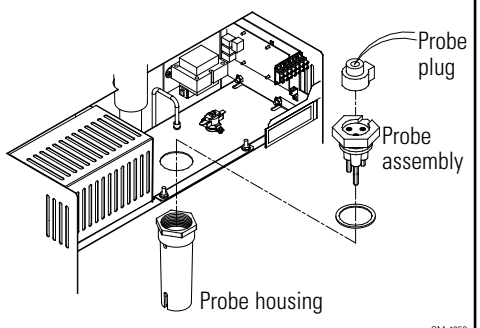
Power

- Turn the supply power on.
  - Verify that the On/Off indicator light illuminates along with the Fill indicator light.
  - Verify that the fill valve opens and adds water until the humidifier chamber is full, at which time the fill valve closes and the Fill indicator light turns off.
  - Verify that there are no leaks from the humidifier.

Create Water Seal

- Unplug the probe plug from the probe assembly (located on the chamber cover; see **Figure 28**) to allow the fill valve to energize and overfill the chamber. This ensures that the water seal (P-trap) is filled with water. When water is seen coming from the drain line, plug the probe plug back into the probe assembly.

FIGURE 28 – Probe Rod Assembly



Initiate Fan Call

- Set up a fan call at the thermostat. If the humidifier is configured to bring on the equipment fan with a humidity demand, skip to next step.

Initiate Humidity Demand

- For the default Model 1150, 1160 and 1180 controls, whether in Automatic or Manual Mode, rotate control knob of the Automatic Steam Humidifier Control clockwise to the 'Test' position.
  - Verify that the steam indicator light illuminates and energizes the heaters. In the 'Test' position, the humidity demand will last for 1 minute only.

WARNING In the event the humidifier chamber does not contain water and the heaters are energized, turn main power off. Operation of the heaters without water may cause humidifier malfunction and/or fire, resulting in property damage, personal injury or death.

NOTE: Do not leave the Automatic Steam Humidifier Control in the 'Test' position. Refer to the Installation and Operation Manual for the Automatic Steam Humidifier Control for more details.

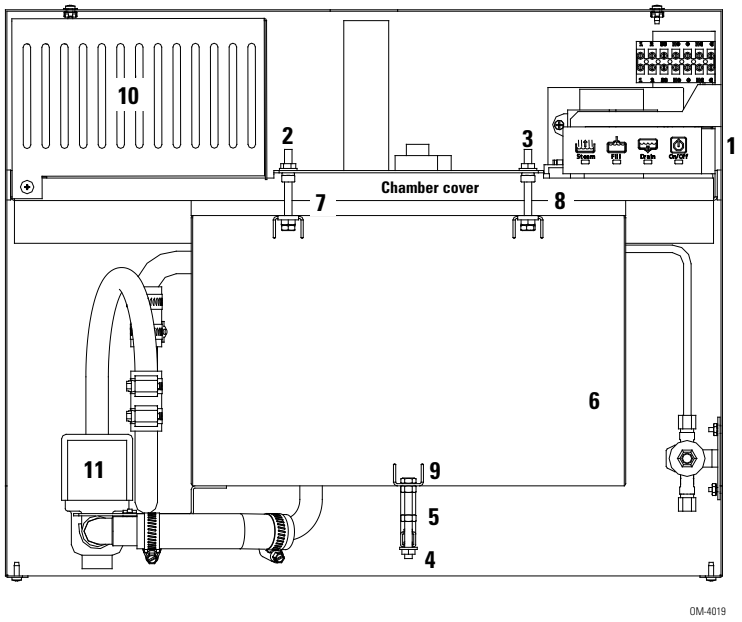
MAINTENANCE

The best way to determine how often the humidifier needs maintenance is to remove the steam chamber and inspect it after the first year of operation. Potable water carries a variety of minerals and other materials in a mix that varies from location to location. This variation in water quality, combined with the hours of operation and duty cycle, determines the frequency maintenance required.

TO INSPECT AND SERVICE HUMIDIFIER:

1. Access and prepare the steam chamber (Item 6) for removal (see **Figure 29** for drawing item numbers):

FIGURE 29 – Chamber with Closed Fastener



A. Loosen the fasteners on the top of the shroud.

B. Remove the fasteners on the bottom of the shroud.

C. Remove the shroud.

CAUTION

If the drain light is blinking on the display panel (Item 1 in drawing), there is water in the chamber that was unable to drain. Model 1180 chambers weigh 60 pounds (27 kg) when full of water; Model 1160 chambers weigh 40 pounds (18 kg) when full of water; Model 1150 chambers weigh 30 pounds (14 kg) when full of water. **Take the necessary precautions to support the additional weight when removing the chamber fasteners.**

WARNING WARNING: Line voltage may cause serious injury or death from electrical shock. Do not remove the power/heater terminal cover (Item 10) while the electrical power is on.

D. If the steam chamber is cool to the touch, skip to Step 1E. If the chamber is hot, the water must be cooled down before draining and handling of the chamber. This can be accomplished by allowing sufficient time for the chamber to become cool enough to handle. As an alternative, if the drain piping is designed to handle intermittent drain water temperatures up to 212°F (100°C), the chamber may be cooled down by moving the lever located on the drain valve actuator to the manual open position. The fill valve eventually opens, allowing water to run into the chamber until it is cool enough to handle.

IMPORTANT: If water is not draining from the chamber after Step 1D, the drain valve is likely clogged and the chamber must be cooled by introducing overfill water into the chamber. To do this, unplug the probe plug from the probe assembly (located on the chamber cover) to allow the fill valve to energize and overfill the chamber. When the chamber is cool enough to handle, plug the probe plug back into the probe assembly. **Take necessary precautions to support the additional water weight when removing the steam chamber fasteners.**

WARNING Opening the drain valve when the steam chamber is hot may discharge water with a temperature up to 212°F (100°C) into the plumbing system. This may cause damage to the plumbing system. Do not touch the chamber or drain piping until the chamber has had sufficient time to cool or serious injury may result.

E. Shut off the water supply.

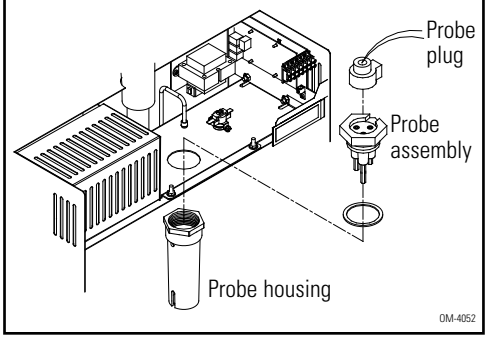
F. Shut off the electrical supply.

G. Allow the steam chamber to completely drain.

H. Disconnect the drain hose or field-installed union from the drain valve connection on the back left corner of the cabinet. Disconnect the drain valve electrical plug.

2. Remove the steam chamber (see **Figure 29** for drawing item numbers):
   - Hold up on the bottom of the steam chamber (Item 6 in drawing) and remove the top mounting nuts (Items 2 and 3).
   - Hold up on the bottom of the steam chamber while removing the bottom mounting nut (Item 4). When the bottom mounting nut is removed, the handle (Item 5) falls away from the steam chamber. Use both hands to support the steam chamber and lower it straight down to clear heaters. Use care not to damage gasket which is attached to the top lip of the chamber.
3. Clean the steam chamber interior by rinsing with clean water. Use a putty knife or similar flat instrument to remove mineral deposits. Clean the strainer inside the steam chamber located over the steam chamber drain opening. Use a wire brush and verify that all the strainer holes are open.
4. Open the drain valve with the manual lever on the side of the actuator (Item 11) and run water through the drain valve to remove any collected sediment.
5. Unscrew the probe assembly and clean the plastic probe housing, ensuring that all passageways are clear (see **Figure 30**). Clean the probe rods using steel wool or a similar mild abrasive material. Inspect the composite plastic probe assembly for any signs of cracking, roughness, or deterioration. Replace if necessary with Part Number 4580.
6. Install the probe assembly, probe plug, probe housing and the gasket into the cover (see **Figure 30**).

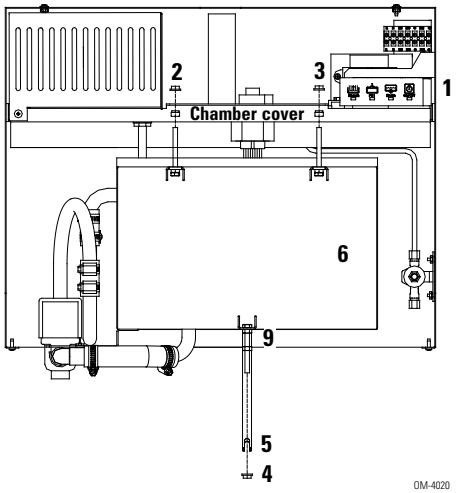
FIGURE 30 – Probe Rod Assembly



7. Re-install the chamber (see **Figure 31** for drawing item numbers):

   - Using both hands, lift the chamber (Item 6 in drawing) up around the heaters until the threaded fasteners penetrate the cover flange.
   - Hold the chamber in place with one hand and pull the handle (Item 5) toward you and up onto the threaded fastener on the front bottom of the chamber. Make sure gasket is centered on chamber flange.
   - Push the handle up against the backing nut (Item 9) and run nut (Item 4) up the threaded fastener so it holds the handle in place.
   - Tighten nut (Items 2 and 3) down on the threaded fasteners extending through the cover flange.
   - Tighten nuts (Items 2, 3, and 4) to complete the process of returning the chamber to its position prior to removal.
   - Reconnect the drain hose to the drain valve connection in the back left corner.
   - Reconnect the drain valve electrical plug.

FIGURE 31 – Chamber with Open Fastener



8. Verify electrical connections:

   - Verify that all power terminal screws and lugs are tight from power block to heaters.
   - Verify that all electrical plugs located under the shroud are completely plugged in (transformer, contactor, drain valve, and fill valve).
   - Check continuity of control relay (smaller top relay) on Model 1150. Replace if shorted.

9. Move the drain valve lever back to the auto position.

10. Turn on the water supply.

11. Turn on the electrical power.

12. Allow the steam chamber to fill with water and initiate a humidity demand signal (see **Figure 32** for drawing item numbers).

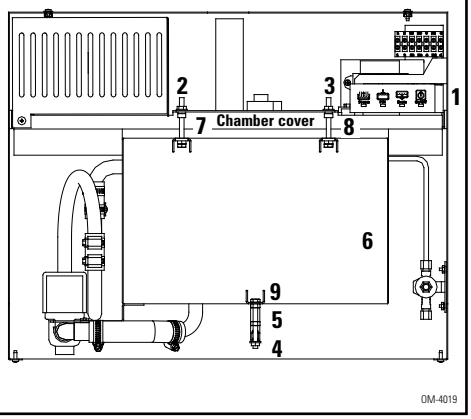
    - **IMPORTANT: Verify that the gasket seal is not leaking prior to leaving the humidifier unattended.**

      – If a leak is observed in the left front or side of the gasket, loosen backing nut (Item 7 in drawing) one turn and tighten fastener nut (Item 2) down onto the cover flange. Continue this one turn at a time until the leak stops.

      – If a leak is observed in the right front or side of the gasket, loosen backing nut (Item 8) one turn and tighten fastener nut (Item 3) down onto the cover flange. Continue this one turn at a time until the leak stops.

      – If a leak is observed in the rear of the steam chamber, loosen backing nut (Item 9) two turns and tighten up fastener nut (Item 4) onto the handle. Continue this two turns at a time until the leak stops. Replace gasket if necessary.

FIGURE 32 – Steam Chamber with Closed Fastener



13. If this maintenance occurred at the end of a humidification season, turn the demand for humidity down to the minimum setting and the humidifier will go into an end-of-season drain after 72 hours.

14. If this maintenance occurred during the humidification season, turn the demand for humidity to the desired set point.

OFF-SEASON SHUT DOWN PROCEDURE

Perform steam chamber cleaning and humidifier maintenance at the end of the humidification season.

- If softened water is used, the steam chamber may not need cleaning until after several humidification seasons.
- **IMPORTANT: The steam chamber should be removed after the first season of use to observe the amount of collected minerals in the chamber.**
- If there is more than ½" (13 mm) of minerals in the steam chamber after one season of use, clean the chamber annually.
- If it is determined that cleaning is necessary every two or three seasons, then the only off-season shut-down procedure required is to turn the demand for humidity down to the minimum setting.
- The steam chamber will go into an end-of-season drain after 72 hours without a demand for humidity.
- When humidification is desired, turn the demand up to the desired set point and the system will start up.

TROUBLESHOOTING

Problem	Possible Cause	Action
All indicator lights are blinking sequentially	The humidifier is in a forced cool-down period prior to a required automatic drain sequence.	• This is normal operation. **DO NOT RESET POWER.** The humidifier will automatically resume making steam once it has cooled down, drained, and refilled.
All indicator lights are off	On/Off switch is off	• Push On/Off switch on display panel.
	Display panel ribbon cable connection	• Connect display panel ribbon cable. • Verify ribbon cable is connected correctly. See **Figures 33 and 34.**
	Transformer secondary circuit breaker tripped	• Check for wiring shorts; reset breaker.
	Power panel breakers are open	• Check power block for proper voltage present at transformer. • Verify transformer electrical plug is fully engaged.
Steam light on the display panel is blinking on and off	The enable/safety circuit is not satisfied.	• If no other lights are on or blinking, check the airflow proving switch: – Verify that tube orientation in the duct is correct. – Verify tube is connected to the switch correctly. – If connections are correct and switch does not close with airflow, replace switch. • Check high humidity limit switch (if installed): – Verify connection per the wiring diagram and the diagram on the high humidity limit switch cover. – Verify that the high humidity limit switch is the correct distance downstream of distribution tube. – If connections and location are correct, replace high humidity limit switch.
	Low water condition	• If the fill light is also on: – Verify that the water shut-off valve is open. – Check fill valve strainer; clean or replace if clogged. • If the fill light is also blinking, refer to the "Fill light on the display panel is blinking on and off" section below. • Verify that lever on drain valve actuator is in 'Auto' position.
Fill light on the display panel is blinking on and off (fill fault) **Unit will not operate**	When in a fill sequence, the internal controller allows 15 minutes for water to reach the maximum upper water level. If water is not sensed at the top probe of the probe assembly after filling for 15 minutes, the fill light on the display panel will blink on and off. There are two causes for this: either the chamber did not fill, or the chamber filled but water is not being detected.	**Chamber is not full** • Verify that lever on drain valve actuator is in 'Auto' position. • Verify that water shut-off valve is open. • Verify that the fill valve electrical plug is fully engaged. • Verify proper fill valve wiring at terminals 33 and C. • Verify voltage supplied to fill valve is correct. Valve coil should be 24 VAC. • Check fill valve strainer; clean or replace if clogged. Check the strainer by disconnecting the fill valve inlet fitting. Remove the strainer with a small screwdriver. • Fill valve may be plumbed backward. Note flow direction and correct as needed. • Verify that water supply pressure is at least 25 psi (175 kPa). • Verify that fill and drain valve wiring are not reversed. • Remove fill valve and check for any foreign material plugging the valve. • Excessive water hammer can bend a needle valve on the supply line and make it difficult to open. If this is happening, the valve may need to be replaced. Install a water hammer shock arrestor. **Chamber is full** • Clean or replace probe. • Check water conductivity. Water conductivity must be at least 100 µS/cm. Add salt to increase.
Drain light on the display panel is blinking on and off (drain fault) **Unit will continue to operate**	When in autodrain sequence or end-of-season drain, the internal controller allows 14 minutes for the water level to drop from the top probe to below the lowest probe. If the chamber does not drain to this level in the time allotted, the drain light on the display panel will blink on and off.	• Verify that drain valve electrical plug is fully engaged. • Check drain valve wiring at terminals 32 and C. • Check for voltage present at the valve. Input power to the drain valve actuator should be 24 VAC; if present, clean or replace valve. • Check if the chamber drain outlet from the humidifier is plugged. Clean if needed.
	Water detection probes	• Clean probes or replace probe rod assembly.
	Fill valve	• Fill valve may be plumbed backwards. Note flow direction on valve body and replumb if necessary. • If fill valve is plumbed correctly and leaking water, replace fill valve.
	Drain line is backing up with water	• Verify drain line pitch. Pitch drain pipe toward drain 1/8"/ft (1%) minimum. • Verify drain line size. If piping run is over 10' (3 m) , increase drain pipe size from ¾" (DN20) to 1¼" (DN32). • Verify that the drain line is not plugged. Disconnect drain piping from the humidifier at the hose or union connection. Replace or clean drain piping if there is standing water in the piping or if water does not flow freely through the drain piping.

Problem	Possible Cause	Action
The On/Off light on the display panel is blinking slowly (one blink per second)	Mineral buildup or oxidation on probe rods	• Remove probe assembly and clean probe rods; reset power to clear warning.
	Deterioration of probe rod assembly	• Replace probe rod assembly.
The On/Off light on the display panel is blinking rapidly (10 blinks per second) (illogical probe fault)	Probe is wired incorrectly	• Verify wiring; see wiring diagram. • Verify that probe wires are routed separately from high voltage wires to avoid interference. • Verify the green and yellow ground wire is connected to the subpanel and to the C terminal.
	Deterioration of probe rod assembly	• Replace probe rod assembly.
	Chamber water is foaming.	• Clean chamber.
No remote fault indication (drain fault, fill fault, illogical probe fault) **Note: This is an optional connection**	Field wiring not installed	• Provide field wiring to a remote fault indicator from NO, O, NC control terminal block.
	Remote fault relay is not switching.	• Check relay continuity NO, O, NC control terminal block for contact closure.
	Field-supplied remote fault indicator lamp is burned out.	• Check if lamp by others is burned out; replace if needed.
System fan/blower doesn't operate	System fan/blower power is off	• Turn power supply on.
	System fan/blower is not wired to internal controller board	• Check wiring diagrams on pages 12, 13, and 14 for wiring to NO, O, and NC terminals.
	Internal controller board is configured for remote fault indication	• Slide switch S2 position 9 must be in 'off' position. See page 15 for more information.
Humidifier does not energize; chamber does not heat up	Nonexistent supply voltage to humidifier	• Check main line fuse. • Check main line safety switch. • Verify relay/contactor electrical plug is fully engaged.
	Nonexistent control voltage	• Check for proper supply voltage per wiring diagram. • Verify proper wiring of multi-tap transformer. • Verify transformer electrical plug is fully engaged. • Check for control circuit voltage, 24 VAC. If voltage is not present at H and C, check transformer circuit breaker. • Reset if needed by pressing On/Off switch on display panel. • Reset manual over-temperature switch located above heater on humidifier cover.
	Humidifier over-temperature thermostat is open.	• Reset manual switch located above heater on humidifier cover. • Verify relay/contactor and transformer electrical plugs are fully engaged.
	Non-resettable over-temperature thermostats (in power lines to heaters) are open.	• Replace non-resettable thermostats. • Check all components for over-temperature damage. • Determine cause of dry fire by checking for a frozen relay/contactor or a probe assembly malfunction and remedy before restarting humidifier.
Reduced or no output (even though water level is correct)	Malfunctioning control system	• Check if auxiliary limit controls are not allowing system to operate, e.g., high humidity limit switch, airflow proving switch, etc.) Reset, replace, or calibrate as needed. • Check if the heater over-temperature thermostat has tripped. Reset if necessary. • Check if the non-resettable over-temperature thermostats have tripped. Replace if necessary.
	Heater malfunctioning	• Verify that relay/contactor and transformer electrical plugs are fully engaged. • Verify that proper voltage is being applied to heaters. • Check heater amperage. • If heater power device is not functioning, replace.

Problem	Possible Cause	Action
Heater burnout	Improper wiring	• Verify proper voltage applied to heater. • Verify proper electrical connections.
	Water level is too low.	• Replace probe assembly.
	Mineral buildup on heaters	• If heaters are on continuously and therefore not expanding and contracting with on-off cycles to shed mineral buildup, the humidifier may be undersized. Replace with a larger unit or add an additional humidifier. • Inspect chamber for severe mineral buildup on or around heater. If present, increase cleaning frequency or use softened supply water.
	Heater corrosion	• Inspect heater for surface corrosion or pitting. This is usually caused by a high chloride level in the supply water.
Unit does not fill with water	No water supply to fill valve	• Verify that manual water supply valve is open and that pressure exists. • Check if water supply line strainer is plugged. Clean strainer or replace. • Verify fill valve electrical plug is fully engaged.
	Unit control is not on	• Press On/Off switch on display panel. • Verify transformer electrical plug is fully engaged.
	Malfunctioning fill valve	• Unplug probe head. Fill valve should open. If fill valve does not open: – Verify fill valve electrical plug is fully engaged. – Verify proper 24 VAC (terminals 33 and C) to fill valve. If voltage is present and valve does not open, replace valve.
	Malfunctioning level control system	• Check terminals 3, 4, 5, and C on the internal controller board terminal block for correct wiring.
	Humidifier is in auto drain mode.	• Normal operation. Chamber will fill after completing auto drain sequence.
Fill valve does not close	Malfunctioning level control system	• Check that probe electrical plug is fully engaged. • Verify that probe is wired per wiring diagram. • Verify the green and yellow ground wire is connected to the C terminal and the subpanel. • If the internal control board relay output is shorted to fill valve coil, replace board. • If needed, clean probe rods. • Check water conductivity. Water conductivity must be at least 100 µS/cm. Add salt to increase.
	Fill valve is stuck open.	• Check for control voltage across fill valve coil (terminals 33 and C on control terminal strip). • Check if fill valve is installed backwards. If yes, repipe. • Check if there is an obstruction that does not allow valve to seat properly. Clean or replace valve as needed.
	Drain valve is open.	• If automatic drain valve is locked in manual open position, reset to automatic. • Replace valve if there is a broken return spring on the drain valve. • Clean or replace drain valve if an obstruction in the valve does not allow complete closure.
Fill valve cycles on and off frequently (several times per minute)	Malfunctioning level control system	• If needed, clean probes. • Verify that probe wiring is correct. • Check water conductivity. Water conductivity must be at least 100 µS/cm. Add salt to increase.
	Drain valve not fully closed	• If an obstruction does not allow drain valve to fully close, clean valve.
Unit does not perform autodrain sequence	No power to automatic drain valve	• Verify drain valve electrical plug is fully engaged. • Check if 24 VAC is present at the internal controller board terminals 32 and C for drain valve.
	Drain fault, plugged drain valve, or plugged drain pipe	• Check drain valve piping.
	Defective automatic drain valve	• If voltage is present at valve and it still does not open, replace valve.
Unit does not perform end-of-season drain	Input signal always has a demand	• Reduce demand signal at the humidistat.
	Drain valve	• Verify drain valve electrical plug is fully engaged. • Verify drain valve is wired correctly to control board. • Check 24 VAC across valve coil during test cycle (terminals 32 and C on control terminal strip).

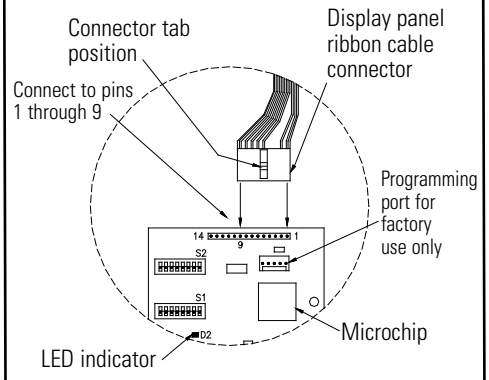
Problem	Possible Cause	Action
Humidity below desired level	No humidity demand signal from humidistat	• Low or no signal from humidistat. Check for proper wiring. • No demand signal by others. • If using Automatic Steam Humidifier Control in the Automatic Mode and the temperature outside is greater than 60°F, the unit will not operate. If humidity is desired in those conditions, run the Control in Manual Mode. • If using Automatic Steam Humidifier Control, verify that the Control is not in Test Mode.
	Unit is operating but fails to meet required humidity output	• If steam is passing to the plumbing system drain, the P-trap is not filled with water: – Disconnect the probe assembly to allow the fill valve to overfill the chamber to fill the P-trap. – If there is excessive internal steam pressure, determine the cause of the high pressure (e.g., high duct static pressure, undersized orifices in distribution tube) and repair as required. • If drain valve does not close fully, determine the cause and clean, repair, or replace as needed. • If fill valve is stuck open, repair or replace. • Replace leaking gasket or vapor hose. • Unit is undersized; replace with a larger unit or add additional humidifier.
	Heating elements not operating	• Verify that humidistat is calling for humidity. • Check for control voltage if limit controls (airflow proving switch, etc.) are not allowing unit to operate. • Verify relay/contactor and transformer electrical plugs are fully engaged. • Check if the heater over-temperature switch has been tripped. Reset or replace if necessary. • Check water conductivity. Water conductivity must be at least 100 µS/cm. Add salt to increase. • Check if the non-resettable over-temperature thermostats have tripped. Replace if necessary. • If heaters are burned out, refer to "heater burnout" problem on page 41.
	Humidity control input type not the same as the operating mode.	• Check the internal control board connections and slide switches S1 and S2 positions 1 and 2. See pages 15-16 and 27-28 for more information.
	Excessive outside air volume	• Verify proper operation of fans and dampers.
Humidity above set point	Improperly located humidistat	• Relocate, using guidelines described on pages 18-19.
	Reduced airflow	• Check fans and dampers.
	Malfunctioning controls	• Check for incorrect supply voltage. • Check for incorrect control signal. • Check for improper wiring hookup. • Check if relay/contactor shorted. Repair or replace as needed.
	Improper slide switch settings	• If the humidifier is receiving a 4-20 mA signal by others, the slide switches need to set as shown on pages 15-16 and 27-28 or the humidifier will run continuously.
Hunting (humidity swings above and below desired set point)	Malfunctioning control system	• If there is a faulty or inaccurate humidity controller, replace. • Relocate improperly located control components. See humidity control placement information on pages 17-19.
Noisy operation	Thunder-type noise is coming from chamber during refill.	• This is normal on larger units and is caused by the cold fill water collapsing steam in the chamber. Reduce water pressure (minimum of 25 psi [172 kPa]) if inlet water pressure is too high.
	Contactor noise	• Verify that contactor and transformer electrical plugs are fully engaged. • Verify 24 VAC at H on internal control board and at C on terminal strip. • Contactor normally makes a "clunk" sound as it pulls in. A continuous chattering noise is not normal and is symptomatic of a failing contactor or malfunctioning controls. Replace contactor or troubleshoot the control system.
	Fill valve noise	• A clicking sound as the fill valve opens or closes, and a hissing sound during fill are normal. A slamming sound as fill valve closes is "water hammer" and can be minimized by installing a shock arrestor. • A loud buzzing sound indicates poor alignment of valve plunger. Replace valve.
Steam exiting drain line	Dispersion tube orifices facing directly into airstream	• Orient distribution tube so orifices do not face directly into airstream. Do not orient tube so orifices are angled downward.
Water dripping from dispersion tube into duct	Dispersion tube orifices facing directly into airstream or angled downward	• Orient distribution tube so orifices do not face directly into airstream. Do not orient tube so orifices are angled downward.

REPLACEMENT PARTS

Note: See page 45 for a listing of replacement part numbers.

FIGURE 33 – Display Panel Ribbon Connection

Internal controller board detail



OM-2030

FIGURE 34 – Display Panel Connector Polarity

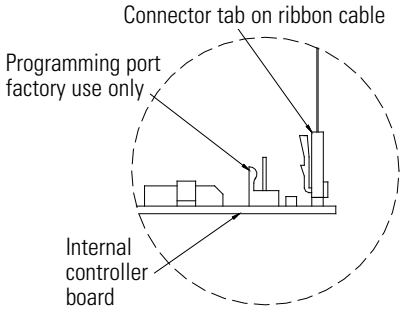


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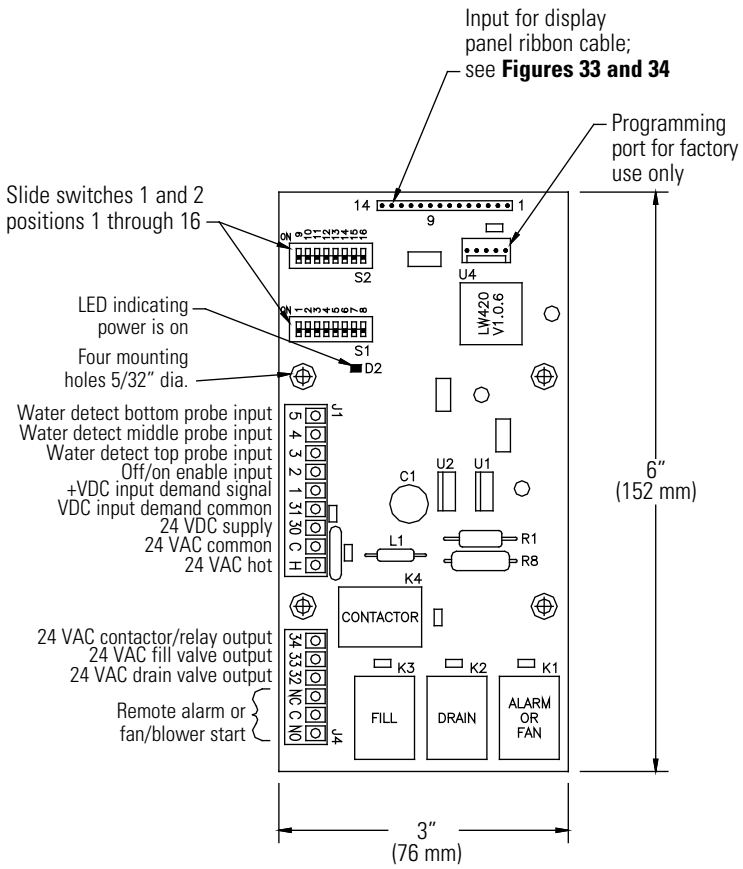
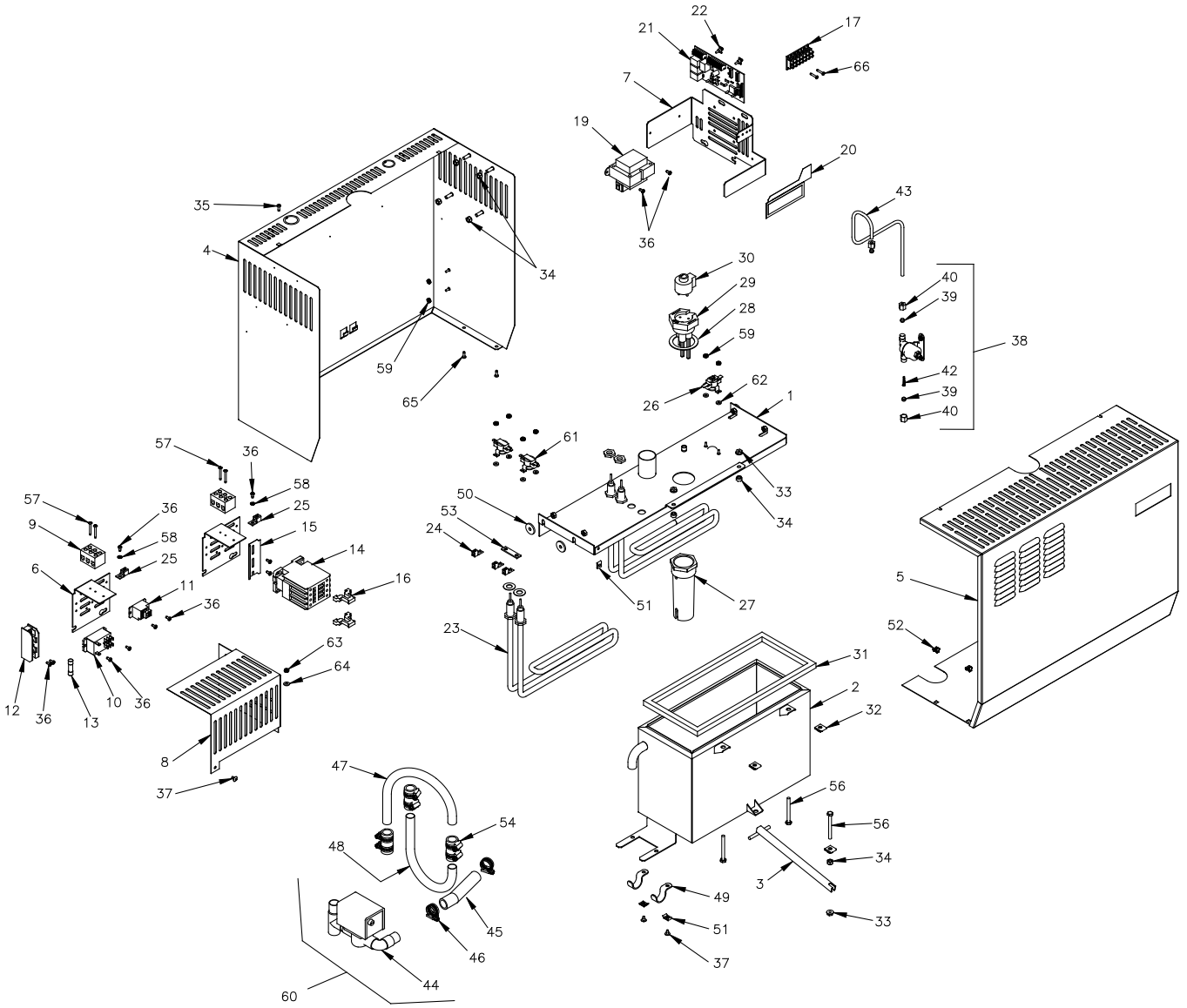
FIGURE 35 – Internal Controller Board



Note:
Terminal blocks J1 and J4 are removable for easier wiring.

OM-2029

FIGURE 36 – Humidifier Replacement Parts



Note: Contact your Aprilaire distributor for availability of parts not listed above.

OM-4040

TABLE 8 – Replacement Parts (refer to Figure 36)

No.	Description	Part Number
2	Steam Chamber with gasket, 1150	4560
	Steam Chamber with gasket, 1160	4561
	Steam Chamber with gasket, 1180	4627
3	Quick Release Handle, 1150	4562
	Quick Release Handle, 1160	4563
	Quick Release Handle, 1180	4628
5	Cover/Shroud, Aprilaire, 1150/1160	4564
	Cover/Shroud, Aprilaire, 1180	4629
9	Terminal block, pressure contact, 3-pole	4565
10	Relay, AC safety (1150)	4566
11	Relay, DC control (1150)	4567
12	Fuse holder, single pole 30 amp (for Model 1150 made prior to serial number 1138928)	4568
13	Fuse, 25 amp (for Model 1150 made prior to serial number 1138928)	4569
14	Contactor, 60 AMP (1160/1180)	4570
17	Terminal block w/electrical wiring harness	4637
19	Transformer, 120/208/240/480V 24V Sec.	4572
20	Overlay & switch, LED	4573
21	Circuit Board, Internal Controller	4574
22	Standoff Clips for PC board (set of 4)	4575
23	Heater, 1150/1160	4576
	Heater, 1180	4630
26	Thermo cut-out, resettable	4577
27	Probe housing, nylon	4578
28	Gasket, 2.5" O.D. X 1.9" I.D.	4579
29	Water Level Probe Assembly	4580
30	Plug, 24" vert wire assy probe	4581
31	Gasket, 1150 Steam Chamber	4582
	Gasket, 1160 Steam Chamber	4583
	Gasket, 1180 Steam Chamber	4631
38	Valve assy, 1/4" 24V fill	4584
44	Drain valve assy, 3/4" electric	4585
60	Drain assy, full copper P-trap	4587
61	Thermo cut-out, non-resettable	4595
Not shown in drawing		
	Hose, 1-1/2" ID X 10' wire reinforced, 1150/1160	4588
	Hose, 2" ID X 10' wire reinforced, 1180	4632
	Dispersion tube, 1-1/2" dia 10" active (1150)	4589
	Dispersion tube, 1-1/2" dia 16" active (1160)	4590
	Dispersion tube, 2" dia 25.5" active (1180)	4633
	Duct plate for 1-1/2" dia tube, 1150/1160	4591
	Duct plate for 2" dia tube, 1180	4636
	Airflow switch, AFS-222-112 electric	4592
	Hanging Bracket Kit	4593
	High Humidity Limit Switch	4594
	Automatic Steam Humidifier Control	57

APPENDIX – ABSORPTION DISTANCE CALCULATION

Step 1: Enter the Design Conditions

Percentage of Outdoor Air	**OA:**
Indoor Air Temperature	**T_{Indoor}:**
Setpoint Indoor RH (for the leaving air)	**$RH_{Leaving}$:**

Step 2: Find the 'Moisture Content Factor' for the **leaving** air (**$M_{Leaving}$**)

In **Table 9,** find the intersection of **T_{Indoor}** and **$RH_{Leaving}$**. The intersection of those two points is the 'Moisture Content Factor' for the leaving air.	**$M_{Leaving}$:**

Step 3: Find the 'Moisture Content Factor' of the **entering** air (**$M_{Entering}$**)

Use the following equation to calculate the moisture content of the entering air: **$M_{Entering}$** = **$M_{Leaving}$** x (1 - **OA**/100) **Note:** this step assumes that the outdoor air being brought into the system will contribute an insignificant amount of moisture relative to what's being added by the humidifier.	**$M_{Entering}$:**

For example: *if Outdoor Air percentage is 20% and the* ***$M_{Leaving}$*** *factor is 2.4, the calculation would be:*
$M_{Entering}$ = 2.4 x (1 - 20/100) = 1.92

Step 4: Find the RH for the entering air

In **Table 9,** find the row that corresponds to the temperature **T_{Indoor}**. Then, slide <u>across</u> this row and find the value closest to **$M_{Entering}$**, which was calculated in Step 3. Finally, slide <u>up</u> this column to determine the RH for the **entering** air.	**$RH_{Entering}$:**

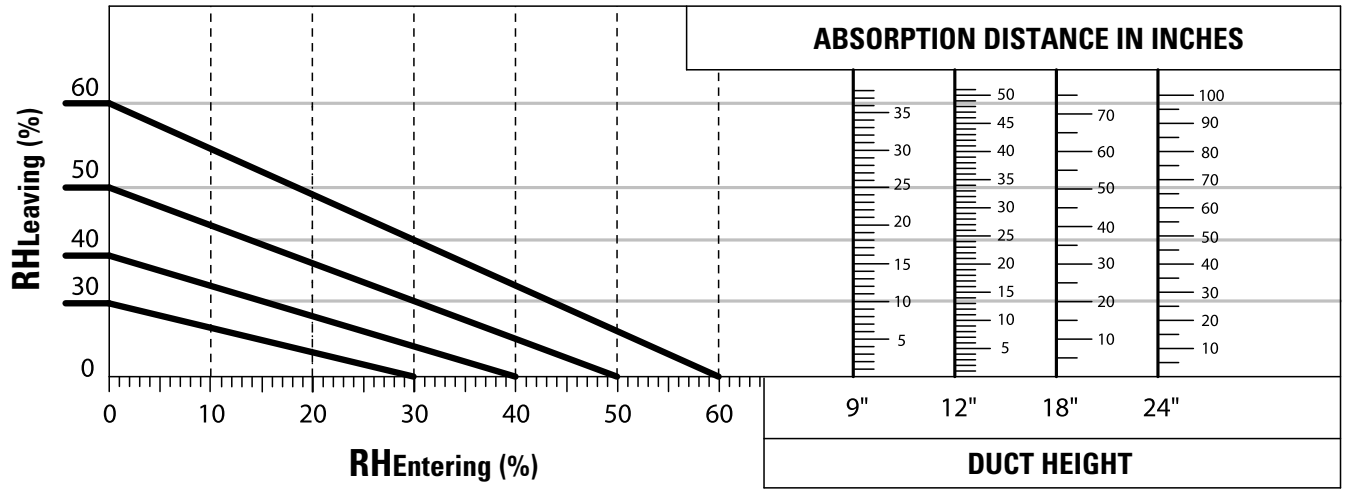
Step 5: Find the Absorption Distance

Using the Absorption Chart, **Figure 37,** draw a vertical line up from the intersection of **$RH_{Entering}$** along the bottom horizontal axis to the intersection of the diagonal line corresponding to **$RH_{Leaving}$**. From this point draw a line horizontally to the intersection of the duct height. This is the minimum required absorption distance for the given duct height and the above Design Conditions. **Note:** 'duct height' assumes a horizontal flow system. For vertical drop systems, duct height should be considered as the duct dimension perpendicular to the distribution tube.	**Absorption Distance:**

Example: *The design conditions of 40% outdoor air, 72°F indoor air temperature, and an indoor RH setpoint of 50% would require an absorption distance of 20" in a system with a duct height of 18". (***$M_{Leaving}$*** would be 3.68,* ***$M_{Entering}$*** *would be 2.20, and* ***$RH_{Entering}$*** *would be 30%)*

		TABLE 9 – Moisture Content Factor											
		$RH_{Leaving}$											
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%
T_{Indoor} (°F)	60	0.22	0.44	0.75	0.89	1.25	1.49	1.74	1.98	2.24	2.50	2.72	2.99
	65	0.29	0.58	0.86	1.16	1.36	1.75	2.04	2.32	2.63	2.92	3.20	3.50
	68	0.32	0.65	0.98	1.30	1.63	1.96	2.28	2.60	2.84	3.26	3.56	3.91
	69	0.33	0.67	1.00	1.33	1.68	2.00	2.35	2.66	3.01	3.35	3.66	4.03
	70	0.34	0.68	1.02	1.37	1.72	2.05	2.40	2.74	3.10	3.44	3.75	4.12
	71	0.36	0.72	1.07	1.43	1.78	2.15	2.50	2.85	3.21	3.55	3.90	4.29
	72	0.37	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.32	3.68	4.03	4.44
	73	0.38	0.76	1.14	1.51	1.90	2.28	2.66	3.03	3.43	3.80	4.16	4.57
	74	0.39	0.78	1.19	1.56	1.97	2.37	2.75	3.13	3.54	3.93	4.31	4.74
	75	0.40	0.81	1.21	1.62	2.03	2.42	2.84	3.23	3.65	4.06	4.45	4.86
	77	0.42	0.85	1.29	1.73	2.16	2.58	3.02	3.42	3.82	4.33	4.73	5.13
	80	0.47	0.94	1.42	1.90	2.37	2.84	3.30	3.75	4.20	4.75	5.19	5.63
	85	0.54	1.09	1.66	2.19	2.78	3.32	3.88	4.39	4.91	5.56	6.07	6.59
	90	0.62	1.25	1.87	2.47	3.12	3.74	4.37	4.95	5.53	6.25	6.84	7.43

FIGURE 37 – Aprilaire Steam Humidifiers – Absorption Distance Chart



WARRANTY

Your Research Products Corporation Aprilaire Steam Humidifier Model 1150, 1160 or 1180 is expressly warranted for two (2) years from the date of installation to be free from defects. Research Products Corporation's exclusive obligation under this warranty shall be to supply, without charge, a replacement for any part of the Steam Humidifier, which is found to be defective within a two (2) year period and which is returned no later than thirty (30) days after the two (2) year period by you or your original supplier to Research Products Corporation, Madison, WI 53701, together with the model number and installation date of the Steam Humidifier.

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